

PD-ABA-025

63262

UNCLASSIFIED

INTERNATIONAL DEVELOPMENT

COOPERATION AGENCY

AGENCY FOR INTERNATIONAL DEVELOPMENT

Washington, D.C. 20523

PROJECT PAPER

BANGLADESH

HOMESTEAD AGROFORESTRY RESEARCH AND EXT.

{388-0062}

JULY 1986

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

**PROJECT DATA SHEET**

1. TRANSACTION CODE

A = Add  
 C = Change  
 D = Delete

Amendment Number

DOCUMENT CODE

3

2. COUNTRY/ENTITY

3. PROJECT NUMBER

388-0062

4. BUREAU/OFFICE

5. PROJECT TITLE (maximum 40 characters)

Homestead Agroforestry Research & Ext.

6. PROJECT ASSISTANCE COMPLETION DATE (FACD)

MM DD YY  
09 30 93

7. ESTIMATED DATE OF OBLIGATION

(Under 'B.' below, enter 1, 2, 3, or 4)

A. Initial FY 86

B. Quarter 4

C. Final FY 90

8. COSTS (\$000 OR EQUIVALENT \$1 = )

A. FUNDING SOURCE	FIRST FY 86			LIFE OF PROJECT		
	B. FX	C. L/C	D. Total	E. FX	F. L/C	G. Total
AID Appropriated Total	3,000		3,000	11,140	3,360	14,500
(Grant)	( 3,000 )	( )	( 3,000 )	( 11,140 )	( 3,360 )	( 14,500 )
(Loan)	( )	( )	( )	( )	( )	( )
Other U.S.						
1.						
2.						
Host Country		2,500	2,500		2,500	2,500
Other Donor(s)						
<b>TOTALS</b>	<b>3,000</b>	<b>2,500</b>	<b>5,500</b>		<b>5,860</b>	<b>17,000</b>

9. SCHEDULE OF AID FUNDING (\$000)

A. APPRO. PRIATION	B. PRIMARY PURPOSE CODE	C. PRIMARY TECH CODE		D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1)	210	080				14,500		14,500	
(2)									
(3)									
(4)									
<b>TOTALS</b>									14,500

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

012 023 067 079 160 968

11. SECONDARY PURPOSE CODE

121

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code R/AG BSW TNG INTR  
B. Amount

13. PROJECT PURPOSE (maximum 480 characters)

Enhance the capacity of institutions within the Ministry of Agriculture and Forests to carry out research, extension, training, and education to better assist rural families to increase production of trees, shrubs, bamboos, and ground covers on their homesteads.

14. SCHEDULED EVALUATIONS

Interim MM YY MM YY Final MM YY  
07 88 02 91 11 92

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000  941  Local  Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of a \_\_\_\_\_ page PP Amendment.)

17. APPROVED BY

Signature

*John R. Westley*  
John R. Westley

Title

Director  
USAID/Dhaka

Date Signed

MM DD YY  
07/19/86

18. DATE DOCUMENT RECEIVED IN AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

Mary J. Lewellen 7/30/86  
Mary J. Lewellen, CONT(A)

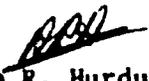
# UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

Dhaka, Bangladesh

ACTION MEMORANDUM FOR THE DIRECTOR

July 9, 1986

FROM :  Alan K. Hurdus, Director(A), F&AGR

Problem:

Your approval is required for grant funding of the Homestead Agroforestry Research and Extension Project (388-0062). Life-of-project funding will total \$14,500,000, to be incrementally funded in fiscal years 86 through 90, with an initial obligation of \$3,000,000. The source of funding is FAA Section 103, Agriculture, Rural Development and Nutrition.

Discussion:

The BDG and several donors have been increasing the level of resources available for forest production. Large scale programs are underway to develop mangrove forests on lands newly formed in the Bay of Bengal. Efforts are being made to increase production from the Chittagong Hill Tracts and other forest reserves. Strip plantations are being attempted along public roads, railway beds, and canal embankments. Until now, however, only limited measures have been taken to increase forestry production on the nation's rural homesteads. The major reason is that until very recently the country's forestry institutions had little they could offer small farmers in terms of improved varieties or cultivation techniques.

Some beginnings, however, have been made in changing this situation. Forestry research priorities have begun to shift toward areas of more direct relevance to small farmers. The various extension services are beginning to include forestry matters in the messages they carry. This Project should accelerate and expand this process, as it will emphasize institutional strengthening of agroforestry research, extension, and training capability within the Ministry of Agriculture and Forests (MAF). Through these efforts, the Project goal will be met: the Bangladesh government will build a sustained capability to provide rural families with improved biological materials and management technologies which allow self-sufficiency in tree-based products through production on privately-held homestead land.

USAID will provide \$300,000 for pre-implementation activities, \$6.6 million for technical assistance, \$745,000 for commodities, \$1.04 million for training, \$3.0 million in financial support of research and extension activities and an additional \$2.815 million to cover contingencies and inflation. The BDG will provide matching resources of approximately \$2.5 million in the form of: salaries and overhead; vehicle operation; research expenses; and administrative costs.

Specifically, the Project will:

- Establish an Agroforestry Research Cell at the Forest Research Institute (FRI) to carry out laboratory and field station research.

- Establish new Homestead Agroforestry Teams (HAT) to design and carry out homestead trials at Farming Systems Sites (FSS) distributed over diverse agro-ecological zones. The Bangladesh Agricultural Research Council (BARC) will coordinate establishment and administration of these units, while scientific support for research by the HATs will be provided by FRI.

- Establish an Agroforestry Extension Cell within the Department of Agricultural Extension (DAE) to coordinate agroforestry-related training and extension activities.

- Establish a new contract research fund at BARC which will support researchers in adopting new lines of agroforestry-related research.

In addition to these institutional innovations, the Project will support training activities to upgrade individual knowledge and skills:

- Scientists, administrators, and extension workers will be provided international training in agroforestry and related fields. A variety of training activities — degree programs; research associateships; attendance at international workshops and study tours will be supported.

- Three or four sessions of a Six Month Agroforestry Course will be organized in Bangladesh to train: Agroforestry Scientific Officers (AFSOs) who will work at the FSSs; mid-career DAE officials who will in turn train newly recruited extension workers; and Forest Department (FD) officials who will work in agroforestry programs.

- Courses and workshops will be offered to extension officers, other government officials, non-government organization (NGO) employees, and rural residents.

- New curriculum materials in agroforestry will be developed for agriculture students and trainees at a number of institutions.

The Project has been under development for almost two years. Technical details have been worked out in close collaboration with BARC, FRI, FD and DAE. A major delay occurred as the MAF made certain that this Project was well integrated into its forestry program, and that there was no duplication of efforts with regard to a proposed Second Phase Asian Development Bank-supported Social Forestry Project.

The Mission Advisory Committee (MAC) met on 30 June, 1986, and recommended project approval. The issues discussed at the MAC included the lack of an Implementation Plan in the Project Paper (PP), the adequacy of the Financial and Economic Analysis, the number of project beneficiaries, other donor support to forestry research, linkages with international agricultural research centers, administration of contract research funds and the adequacy of agroforestry technical expertise within the Mission. The issues have been resolved as follows:

- An "Implementation Plan" has been included in the PP.

- It was agreed that an ex ante economic analysis of an institution building/research project such as this is not necessary. Rather, carefully done ex post studies will be carried out. The recurrent cost part of the "Financial and Economic Analysis" section was also expanded and strengthened.

- After rechecking some basic assumptions, the numbers of project beneficiaries in the log frame was raised from 100,000 to 300,000 families.

- The section on "Conformity with Current Policies and Programs in Bangladesh" was strengthened to include a description of all donor activities in forestry research.

- In accordance with a recent audit report, the PP now includes an expanded description of how national agricultural research organizations will coordinate and cooperate with appropriate international agricultural research centers.

- Additional language in the Project Grant Agreement and the PP has been included to clarify the point that both contract and core research funds provided under this Project will be disbursed through the T.A. contract.

- It was agreed that the current agronomic and economic expertise within the Office of Food and Agriculture, coupled with regional and central forestry expertise, was sufficient to handle project implementation.

The conditions and covenants required for the Project are set forth in the Project Authorization which is attached for your signature. Your signature on the Project Authorization will also approve a waiver of the requirement that the cooperating country contribute 25% of the cost of the Project.

Recommendation: That you approve the Homestead Agroforestry Research and Extension Project and that you authorize a life-of-project funding level of \$14.5 million by signing the attached Project Authorization.

Attachments:

1. Project Authorization
2. Project Paper
3. Draft Project Grant Agreement

# UNITED STATES OF AMERICA

AGENCY FOR INTERNATIONAL DEVELOPMENT

Dhaka, Bangladesh

## PROJECT AUTHORIZATION

Name of Country: Bangladesh      Name of Project : Homestead Agroforestry  
Research and Extension

Number of Project: 388-0062

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Homestead Agroforestry Research and Extension Project for the People's Republic of Bangladesh (the "Cooperating Country") involving planned obligations of not to exceed Fourteen Million Five Hundred Thousand United States Dollars (\$14,500,000) in grant funds over a seven year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/ allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is seven years from the date of initial obligation.

2. The project will provide dollar costs and a portion of local currency costs required to support expansion of research, extension and training activities in Homestead Agroforestry. The project goal is to increase rural incomes through greater production of fuel, fodder, construction and handicraft supplies, and food on privately-held homestead land.

3. The Project Agreement(s) which may be negotiated and executed by the officer(s) to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority shall be subject to the following essential terms and covenants and major conditions, together with such other terms and conditions as A.I.D. may deem appropriate:

a. Source and Origin of Commodities, Nationality of Services

Except as A.I.D. may otherwise agree in writing:

(1) Commodities financed by A.I.D. under the project shall have their source and origin in Bangladesh or in countries included in A.I.D. Geographic Code 941;

(2) Except for ocean shipping, the suppliers of commodities or services shall have Bangladesh or countries included in A.I.D. Geographic Code 941 as their place of nationality; and

(3) Ocean shipping financed by A.I.D. under the project shall be financed only on flag vessels of the United States, Bangladesh, or other countries within Code 941.

b. Conditions Precedent to Disbursement

Prior to any disbursement, or to the issuance of any commitment documents under the Project Agreement, except for technical assistance, the Grantee shall furnish in form and substance satisfactory to A.I.D., a plan for establishment and adequate staffing of the following two new administrative units within the Ministry of Agriculture and Forests (MAF) to implement the Project:

(a) a new Agroforestry Cell within the Forest Management Research Branch of the Forestry Research Institute (FRI), and

(b) a new Agroforestry Cell within a Division of the Department of Agricultural Extension (DAE).

Disbursements of tranches after the initial fiscal year will be made conditional upon satisfactory progress toward the establishment and adequate staffing of these administrative units.

c. Covenants

The Grantee shall covenant that:

(1) The FRI and each MAF research organization supported by A.I.D. funds will readily make available in reasonable quantities all genetic material developed under the Project, such as exotic species, superior provenances and improved varieties of multipurpose or fruit trees, for nursery propagation in the public sector by all other MAF units, organizations, and agencies and to the private sector as deemed appropriate by the parties;

(2) The MAF and the Bangladesh Agricultural Research Council (BARC) will release project funds in a timely manner to the Agroforestry Division, FRI, to the Agroforestry Cell, DAE, and to other agencies or institutions charged with implementation of the Project;

(3) MAF, BARC, and the Forest Department (FD) will cause at least 50 persons to be newly recruited or reassigned, nominated and cleared for attendance at the Six Month Agroforestry Course. After satisfactory completion of the Course, trainees will be assigned as Agroforestry Scientific Officers to Homestead Agroforestry Units at the Farming Systems Sites, as Agroforestry Instructors at the Agricultural Training Institutes, as Agroforestry Subject Matter Specialists assigned to new districts, or in other capacities as agreed by USAID and MAF;

(4) Under applicable BDG regulations, MAF and its constituent administrative units will assign and post individuals trained as Agroforestry Scientific Officers in the Six Month Agroforestry Course to appropriate positions at Farming Systems Sites, Agricultural Training Institutes, or elsewhere for periods acceptable to AID (generally at least three years).

(5) BARC will solicit and evaluate proposals and award Agroforestry Contract Research Grants in two or more annual cycles. All proposals shall be subjected to scientific peer review, and shall be accepted or rejected within 180 days of the applicable proposal submission date.

(6) During the last four years of the Project, the BDG will provide increasing levels of funding for activities initiated under the project. Specifically the BDG will:

(i) Provide budgetary support for core research activities in agroforestry (e.g., long term species trials, provenance trials) at the Forest Research Institute as follows:

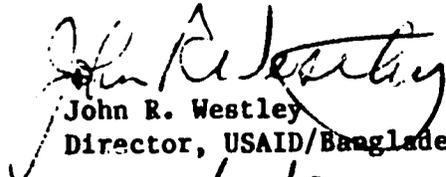
BDG Fiscal Year 1989-90 - 25%  
BDG Fiscal Year 1990-91 - 50%  
BDG Fiscal Year 1991-92 - 75%  
BDG Fiscal Year 1992-93 - 80%

(ii) Provide budgetary support for contract research activities in agroforestry administered by the Bangladesh Agricultural Research Council as follows:

BDG Fiscal Year 1989-90 - 10%  
BDG Fiscal Year 1990-91 - 20%  
BDG Fiscal Year 1991-92 - 30%  
BDG Fiscal Year 1992-93 - 40%

4. Waiver

The requirement of Section 110(a) of the Foreign Assistance Act of 1961, as amended, (the "Act") that the Cooperating Country contribute 25% of the cost of the Project is hereby waived pursuant to Section 124(d) of the Act, on the grounds that the Cooperating Country is a Relatively Least Developed Country, and will make substantial contributions to the Project.

  
John R. Westley  
Director, USAID/Bangladesh  
Date: 7/10/86

Clearance: F&AG/AHurdus AAH  
PDE/MMCalavan (draft)  
PDE/DReese DR  
CONT/MLLewellen MLL 7/10/86  
PRG/TBethune TB 7/10/86  
DD/BApounds BA 7/10/86

Drafted:RLA/SCAllen:msj:5/12/85  
Redrafted:RLA/MSJamal:7/2/86

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**ANNEX C**

- A. PID APPROVAL CABLE**
- B. LOGICAL FRAMEWORK**
- C. INITIAL ENVIRONMENTAL EXAMINATION**
- D. STATUTORY CHECKLIST**
- E. REQUEST FROM BDG**
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- I. SOME OBSERVATIONS ON HOMESTEAD AGROFORESTRY IN  
GOLLA VILLAGE, DHAKA DISTRICT**
- J. INSTITUTIONAL ANALYSIS**
- K. ISSUES IN PROJECT IMPLEMENTATION**

## LIST OF ABBREVIATIONS

ADB	=	Asian Development Bank
AFSO	=	Agroforestry Scientific Officer
AID/W	=	The Head Office of USAID in Washington, D.C.
ANE	=	Asia/Near East Bureau of USAID
ATI	=	Agricultural Training Institute
BADC	=	Bangladesh Agricultural Development Corporation
BARC	=	Bangladesh Agricultural Research Council
BARI	=	Bangladesh Agricultural Research Institute
BDG	=	Bangladesh Government
BJRI	=	Bangladesh Jute Research Institute
BRAC	=	Bangladesh Rural Advancement Committee
BRDB	=	Bangladesh Rural Development Board
DAE	=	Department of Agricultural Extension
FD	=	Forest Department
FFRED	=	Forestry/Fuelwood Research and Development Project
FMRB	=	Forest Management Research Branch (of FRI)
FRI	=	Forest Research Institute
FSS	=	Farming Systems Site
HAT	=	Homestead Agroforestry Team
ICRAF	=	International Centre for Research on Agroforestry
IUFRO	=	International Union of Forestry Research Organizations
MAF	=	Ministry of Agriculture and Forests
MCC	=	Mennonite Central Committee
MLT	=	Multi-Location Testing Site
NFTA	=	Nitrogen Fixing Tree Association.
NGO	=	Non-Governmental Organization
PIAP	=	Project Impact Assessment Plan
PSC	=	Public Service Commission
RDRS	=	Rangpur-Dinajpur Rehabilitation Service
SMAC	=	Six Month Agroforestry Course
SMO	=	Subject Matter Officer
SMS	=	Subject Matter Specialist
SRS	=	Silviculture Research Station
SRTI	=	Sugar Research and Training Institute
UKO	=	Upazila Krishi (Agricultural) Officer.
USAID	=	United States Agency for International Development

## UNITS AND MEASURES

Bigha	=	Unit of land measurement: 1 acre = 3 bighas.
Crore	=	Counting unit: 1 crore = 10,000,000
Decimal	=	Unit of land measurement: 1 acre = 100 decimals
Lakh	=	Counting unit: 1 lakh = 100,000
Maund	=	Weight unit: 1 maund = 82 lb. (1 md = 40 seer)
Seer	=	Weight unit: 1 seer = 2.05 lb (1 seer = 1 kg)
Taka	=	Currency unit: Tk. 1 = \$0.38 or \$1.00 = Tk. 26.2
Union	=	Political unit: Contains 10-20 villages and about 20,000 people.
Upazila	=	Political unit: Contains 6-12 Unions and about 200,000 people.
Zila	=	Political unit: Contains 6-10 Upazilas and 1-2 million people.

## HOMESTEAD AGROFORESTRY RESEARCH AND EXTENSION PROJECT

### EXECUTIVE SUMMARY

The Project will emphasize institutional strengthening of agroforestry research, extension, and training capability within the Ministry of Agriculture and Forests. Through these efforts, the Project goal will be met: the Bangladesh government will build a sustained capacity to provide rural families with improved biological materials and management technologies which allow self-sufficiency in tree-based products through production on privately-held homestead land. USAID will provide \$300,000 for pre-implementation activities, \$6.6 million for technical assistance, \$745,000 for commodities, \$1.040 million for training, \$3.0 million in financial support of research and extension activities and an additional \$2.815 million to cover contingencies and inflation. The BDG will provide matching resources of approximately \$ 2.5 million in the form of: salaries and overhead; vehicle operation; research expenses; and administrative costs.

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- o Courses and workshops will be offered to extension officers, other government officials, non-government organization (NGO) employees, and rural residents.

- o New curriculum materials in agroforestry will be developed for agriculture students and trainees at a number of institutions.

The Office of Member-Director for Forestry at BARC will have the lead responsibility in project coordination. This responsibility includes: overall financial management; coordination among institutions; establishment of HATs; administration of contract research funds; and liaison with the TA Team.

FRI scientists will carry out applied research at Chittagong headquarters and at Silviculture Research Stations (SRS) in each of the major regions of Bangladesh. They will provide information on research to AFSOs at the FSSs. AFSOs will be in daily contact with rural residents and will take the lead in designing, implementing, and analyzing homestead trials, they will have ready access to technical advice and assistance from BARC coordinators and FRI scientists. Successful trials will result in technical recommendations to be passed to rural families through the DAE. Special workshops and the existing system for dissemination of technical information—District Technical Committees, Subject Matter Specialists (SMS) and Subject Matter Officers (SMO), and fortnightly training sessions will ensure that information is passed rapidly.

The Project will provide funds for contract research in agroforestry under BARC administration. These funds will be disbursed through the TA Contract. Research proposals will be reviewed on a competitive basis under several topic modules. Also, "core" research activities at FRI—provenance tests, species trials and tree breeding will be directly funded by the Project. In addition, Project funds will support: purchase of vehicles (for travel to field sites, seminars, coordination committee meetings, field days, etc), establishment of an Agroforestry Association, a publication series, and frequent field days at FSSs, SRSs, and regional agricultural research stations. Finally, members of the TA Advisory Team will work at BARC, FRI, DAE, and the Forest Department's (FD) Forest Academy.

Observable impacts on homestead production practices are anticipated within the seven year life of the Project. Several years of already completed research—species and provenance trials, development of new propagation techniques, and testing of canes, groundcovers, shrubs, etc. ensure that promising homestead trials at

FSSs can be initiated quickly. However, even fast growing trees mature more slowly than field crops, and widespread adoption of "breakthrough" technologies will come only at the end of the Project or in later years. Fortunately, the Project can do much to encourage increased planting of already available species, and support increased production efficiency by introducing modest innovations. In the long run, if known technologies are supplemented with new ones, and Bangladesh achieves a sustained capacity for agroforestry research, the Project's impact on homestead production systems can be enormous.

## The Challenge

In Kishoreganj District in Northern Bangladesh, potters are rapidly going out of business. The cost of fuel for their kilns is rising faster than the prices they receive for their wares (New Nation, February 21, 1985). A household head in Brahmanbaria District owns no field land and a minuscule homestead. As it becomes increasingly difficult to collect fuel on public land, he sometimes finds it necessary to slip out after dark and cut branches from the fence rows of neighboring homesteads. In many areas of rural Bangladesh, families are lighting their chulas (earthen stoves) only once or twice daily, due to shortage or high prices of fuel (Appendix F).

Village-to-village marketing networks in Northern Bangladesh facilitate exchange of rice straw (for fodder) over thousands of square miles. In January, 1985 a cart load of straw in Bogra District was worth Tk. 400. After covering 50 miles on cart tracks and roads, being ferried across the Jamuna River, and delivered in Jamalpur, it brought Tk. 1000. Poor farmers in Brahmanbaria are regularly forced to sell their cattle (in a depressed market) after the plowing season, and to buy new ones several months later, at a much higher price. Why? These families are not self sufficient in fodder, and are unable to pay the prices charged when flood waters are high and crop residues are scarce (Appendix F.)

Poor Brahmanbaria families attempting to keep cattle during the annual fodder shortage season must send women and children daily to collect grass. They travel as far as four miles to a swampy area where grass was traditionally abundant. Increasingly, they must compete with others for limited supplies. Heated words have already been exchanged, and the probability of physical violence increases from year to year (Appendix F).

In most countries, the water hyacinth is a noxious weed that clogs rivers, lakes, canals, and ditches. Millions of dollars are spent in maintaining tenuous control. In Bangladesh, too, it grows rapidly and clogs water-ways. However, the problem is seldom permanent or insurmountable, since in most areas hyacinths have become a resource, essential to the economic stability of poor families. They are collected as a low grade cattle feed, used as an inferior mulch/fertilizer, and when dry, used as an inefficient cooking fuel. (Three-four baskets of dried hyacinths are required for one day's cooking.)

With introduction of new water pumps, and newly developed rice and wheat varieties, boro (winter) grain production is spreading rapidly, thereby increasing grain and straw supplies available to better off cultivators. However, the fallow areas in which all villagers formerly allowed their cattle to graze have been

dramatically reduced.

Rural Bangladesh currently faces two related and pressing problems: a) an accelerating scarcity of fuelwood and other forest products as population pressure increasingly makes itself felt; and b) the rising costs of maintaining soil fertility and agricultural productivity as cow dung and crop residues are increasingly used as fuel rather than as organic fertilizer and fodder. Unlike other countries in the region, Bangladesh has severely limited tracts of forest lands. The country has an extraordinarily high population density (1800 people per square mile) distributed fairly evenly over its area. Virtually the entire country is under cultivation. As such, it depends heavily on trees grown on individual homesteads for most of its wood needs. The Food & Agriculture Organization of the United Nations (FAO) and the Bangladesh Government (BDG) Planning Commission estimate that, while homestead forestry areas represent only 10% of forested land, they supply 70% of all logs sent to sawmills, and 90% of all fuelwood and bamboo.

The best FAO/Planning Commission estimates indicate that annual per capita fuelwood consumption level in 1980 was one of the lowest in the Third World—only 2.7 cubic feet (cft) per rural inhabitant. This represents a 50% decline from the estimated consumption of 5.4 cft. in 1955. The same study suggest that an annual per capita fuelwood availability of at least 9 cft. is called for if the practice of burning agricultural residues is to be halted and adequate heating and cooking energy is to remain available. (These figures become more meaningful in both relative and absolute terms when compared with 1980 annual fuelwood consumption estimates for India-7 cft, Sri Lanka-11 cft, Nepal-20 cft, and Tanzania-82 cft).

Consumption is still declining and relative prices of wood products are rising. The Bangladesh rural poor, who traditionally were able to gather residual fuels (e.g. twigs, leaves, dung) on wealthier farmers' lands often are no longer afforded that right. According to the UNDP/FAO paper "Supply and Demand of Forest Products and Future Development Strategies," if trees continue to be depleted at current rates, annual fuelwood availability per rural inhabitant will decline to 0.7 cft by the year 2000.

For the most part, fuelwood scarcity cannot be alleviated by greater use of gas, kerosene, or electricity. Rather, rural people in Bangladesh must resort to agricultural residues and dung for fuel. Agricultural residues once used to feed draft animals essential for soil preparation, or as organic fertilizer, are no longer available for these purposes. The consequences are readily observable. Per capita livestock supplies are dwindling and soil structure and fertility are declining.

A major reason that the fuelwood/forest products situation in Bangladesh has become so strained is that until a few years ago, there was little governmental awareness that a problem existed. As recently as 1978, the BDG Planning Commission, using data produced in a 1975 survey, argued that a proper balance existed between homestead tree production and utilization. Thus there was no pronounced

governmental effort to mount activities to address and ameliorate the (unperceived) problem. Government forestry establishments--the Forest Department (FD) of the Ministry of Agriculture and Forests (MAF), Forest Research Institute (FRI), and the Institute of Forestry of the University of Chittagong--continued to focus their efforts in areas of traditional responsibility. They emphasized protection and exploitation of the country's National Forests and Forest Reserves.

Over the past several years the situation has continued to worsen and as newer and more carefully designed studies have been done, the nature and immediacy of the problem has become clear. Assisted by several donors (notably the FAO, the World Bank and the Asian Development Bank (ADB), the BDG has initiated a range of projects aimed at increasing the availability of forest products. Initial ADB financed efforts (in the Community Forestry Project) have concentrated on rapid, large-scale planting of trees on public land. While these efforts will have substantial positive impact on availability of forest products, they are insufficient to overcome long term problems. Bangladesh just doesn't have enough public land to produce the wood products needed by its growing population, especially given the practical management and marketing problems involved; nor do most people have sufficient money to buy fuel in the market place. Most of the wood needed by rural people must continue to be produced on private land on the millions of homesteads that constitute village Bangladesh.

Rural residents of Bangladesh are already among the world's most painstaking homestead producers. Yet, they must do better! Fortunately, the picture is not entirely bleak, and there are places where foreign donors, the BDG, and rural Bangladeshi's can productively intervene in the system.

Rural families provide a basis for optimism. They are committed to homestead production; they plant, weed, water, protect, and harvest a wide variety of trees, shrubs, and bamboos. They make special trips to purchase seedlings, and pay premium prices for preferred species. They eagerly seek relevant, understandable, technical information.

A number of scientists have recently recognized a necessity for agroforestry research, and redirected their research accordingly. Valuable work on the "component technologies" of agroforestry production systems is being done at the Forest Research Institute (FRI), the Bangladesh Agricultural University (BAU), and the Bangladesh Agricultural Research Institute (BARI). Several Nongovernmental Organizations (NGO) are supporting tree-planting activities. Due to the efforts of a small number of individuals, a successful agroforestry/resettlement program has been established at Betagi in Chittagong District. The ADB-sponsored Community Forestry Project has facilitated planting of hundreds of thousands of trees.

There is a need and opportunity to strengthen Bangladeshi institutions which can carry out research and extension activities essential to provide rural families with the improved planting materials, management methods, inputs, and information they will require to achieve increasing Homestead Agroforestry production levels. This

Project will provide: \$300,000 for pre-implementation activities, \$6.6 million for technical assistance in agroforestry research, extension, and training; \$745,000 for vehicles, research equipment, training materials and commodities to support laboratory and station research, fieldwork and extension activities, and in-country training; \$1.04 million for U.S., third country, and in-country training in agroforestry research and extension methods, research management and related topics; funding of \$3.0 million for a variety of agroforestry research activities; and an additional \$2.815 million to cover contingencies and inflation.

Participating institutions include: the Bangladesh Agricultural Research Council (BARC); the Forest Research Institute the Department of Agricultural Extension (DAE), and several education and training institutions.

The Project will strengthen the capacity of FRI to carry out laboratory and station research with appropriate species and provenances of fast growing trees, shrubs, bamboos, and groundcovers. New agroforestry research cells (called Homestead Agroforestry Teams--HAT) will be introduced into each of the special research stations which are part of the national system of Farming Systems Sites (FSS). Promising species, management technologies, etc. will be given a "reality test" in a series of homestead trials at FSSs. BARC will supervise introduction of HATs into the FSSs, and will also manage two substantial funds for contract research in agroforestry. DAE will be responsible for training its own field personnel, officials in other departments and ministries, NGO employees, and rural residents in the basic concepts and methods of agroforestry. Later in the Project, as promising species and technologies emerge from the research system, DAE will extend appropriate information and packages to rural families. The Project will emphasize research and extension support for tree, shrub, bamboo, and groundcover production on private land, generally within the homestead.

USAID/Dhaka recognizes that Bangladesh will have a sustained requirement for trained agroforesters. In addition to the challenge of producing fuel, fodder, and other products on private, homestead land, Bangladesh faces other problems for which agroforestry can provide a partial solution--e.g. replanting the denuded hills of Chittagong and the Hill Tracts, stabilizing the Tangail/Mymensingh and Sunderbans forests, community planting on public lands, etc. Agroforesters will be needed to meet each of these problems, and thus the Project also provides support in developing new curriculum materials in agroforestry which can be used in several education and training institutions.

Conformity with Current Policies  
and Programs in Bangladesh

This Project will strengthen the capability of research, extension, and educational institutions within the MAF to assist rural households in increasing production of fuelwood, fodder, timber, bamboo, and other products on rural homesteads. It is consistent with Bangladesh Government (BDG) policy.

The Second Five Year Plan established 10 strategies for the Forestry Sector. Among these are:

Replacement of homestead tree and bamboo wealth.

Introduction of agroforestry practices and forestry rural community development.

The Third Five Year Plan also clearly indicates the government's support for homestead agroforestry:

Farm Forestry: Land used by farmers for growing trees is basically the homestead. But as land is becoming increasingly scarce the trees planted in the homesteads must help rural households increase their output from land and optimize income. About 3% of land is covered by homesteads. This land can be made more valuable by growing trees in combination with minor crops such as vegetables or by intercropping. Knowledge for fruit trees, fast growing plants and minor crops will be disseminated through training at the homestead level. In addition, nurseries will be developed in all the upazilas by Upazila Parishads to supply seedlings to the public. Three thousand six hundred private seedlings growers will be trained for establishing nurseries at the village/union level during the plan period. The programme is to distribute 152 lakh seedlings a year. An important content of rural forestry will be to popularize those plants which can tolerate annual inundation on standing water. There are many indigenous varieties which have high commercial value as soft and hard wood, e.g., Hizal, Jarul, Mandar, Pitali, etc. Seedlings of these varieties will be raised in nurseries and distributed among the public.

Documents establishing the Forest Research Institute list 15 research objectives including the following:

Increase forest productivity in the reforestation programme through the selection, evaluation and pilot plantation testing of fast-growing and high-yielding species and provenances to meet the industrial and domestic requirements including fuelwood ....

Promote the multiple use of land in village and homestead forests and other....lands to improve life styles, by using better agro-forest crops producing forage, fuel, minor forest products, food and timber products.

Until recently, these laudable strategies and objectives existed largely on paper. Protection of reserve forests and efficient plantation management have dominated FD thinking and procedures. The DAE has emphasized grain production in particular and field crops in general. Until recently, the opportunity and challenge of homestead production was unrecognized. However, there are several indications that perceptions have now changed and that the Project will receive adequate support from individuals, units, and leadership of the MAF research and extension system and from individuals and organizations outside government. We note that:

- o The Member-Director for Forestry at the Bangladesh Agricultural Research Council (BARC); several officials at FRI—including the Director, the Chief Research Officer for the Forest Management Research Branch, and the Divisional Forest Officer for the Silviculture Division; a number of professors at Bangladesh universities; and the Secretary of Agriculture are strong supporters of agroforestry research and extension. They have demonstrated their support in public speeches, committee meetings, and publications.

- o Several researchers within the Ministry of Agriculture and Forests are involved with on-going and planned research—species and provenance trials of fast growing exotic trees; vegetative propagation of bamboos; species trials of canes, shrubs and forage plants; breeding of low crown, high yielding fruit trees; and agroforestry resettlement schemes.

- o Administrators of existing and planned Farming Systems Sites have been directed to incorporate research and extension on Homestead Agroforestry into their work.

- o In addition to BDG efforts, several NGOs in Bangladesh e.g. the Bangladesh Rural Advancement Committee (BRAC), Proshika, the Mennonite Central Committee (MCC), the Bangladesh Association for Community Development, and the Rangpur-Dinajpur Rehabilitation Service (RDRS)—have supported tree planting programs on public and homestead land. These organizations can be expected to operate as interest groups, strongly supportive of agroforestry research, training, and extension efforts in general, but particularly willing to support government efforts to introduce, multiply, distribute, and sell high quality seedling stock.

- o The ADB is supporting the FD in implementing a large Community Forestry Project. The Project operates in seven northwestern districts (roughly a quarter of the country) and supports a substantial program in motivational training, free seedling distribution, and planting of FD lands and public lands (e.g. strip plantations adjacent to roads, canals, and railways) degree).

o The ADB is also planning a Horticulture Project that will support improved vegetable and fruit production.

o The Ford Foundation is supporting modest research projects on homestead production and will sponsor participation of local scholars and scientists in a variety of local and international agroforestry workshops.

o The World Bank is also strengthening Bangladesh's forestry institutions. Under the IDA 2 Agricultural Research Project, the Forestry Research Institute is receiving support for core research in the areas of species introduction and testing, seed orchards, land capability assessments, biostatistics and a National Forestry Seed Center. In addition, one long-term advisor is now working at FRI in the area of Silviculture/tree breeding. The IDA 2 Project is also providing contract research funds to BARC directly and providing long term and short term training in-country and abroad for Bangladeshi scientists.

Under the Second IDA Forestry Project, FRI is also receiving support for coastal afforestation research. This includes the creation of plantation trial unit and short term technical assistance. World Bank is also providing a small amount of resources to FRI for bamboo research.

Both World Bank Projects deal primarily with fast growing exotic species for forest plantations.

#### Relationship to Mission, Bureau, and AID Strategy

The Project addresses directly the Mission program goal of increasing agricultural productivity (CDSS, 1986). By enhancing the BDC agroforestry research/extension capabilities the Project furthers specific objectives of: 1) supporting agricultural intensification through adoption of biological technologies and 2) crop diversification. The Project will provide further support to goals already specified in the Mission's Agricultural Research II Project.

Project emphasis is on developing institutional capability for sustained research and extension efforts to support production on private land within homesteads, on paddy field bunds, and on the privately-held margins of tanks and canals. The Project complements our Agricultural Research Project in these regards, since the latter emphasizes field crop production.

The "social forestry" concept discussed in the 1986 CDSS for development in FY85 and initial obligation in FY86 has been refined to "Homestead Agroforestry". Initial obligation is anticipated in late FY86.

The Project supports the three main objectives of the current (February, 1984) AID Forestry Strategy. It will:

1. Help meet the short-term needs of rural and urban populations in the developing countries for forest products like fuel, food fodder, and building materials as well as for income and employment.

2. Strive concurrently to improve the agricultural base through advancement of agroforestry, and problems of soils and water conservation and management.

3. Improve and enhance the natural resource base over the long run through widespread adoption of effective multiple use management and conservation practices.

Furthermore, it is consistent with decisions recorded in the AID Forestry Strategy to "foster increased cooperation between agriculture and forestry" and to "support agroforestry as an integral part of farming systems development and research".

The Project will support AID concerns for including women in the development process by working with cooperating rural families at the FSSs, rather than with cooperating farmers, and by insuring that the extension system reaches rural residents of both sexes. The Project will insure that both males and females are reached at FSSs by filling 40-60 percent of all field assistant positions with women. Furthermore, particular care will be taken to ensure that female extension agents already working in DAE will receive available training in Homestead Agroforestry.

#### Linkages with International Agricultural Research Centers (IARCs) and Centrally Funded Projects

During preparation of the Project Paper we have explored possible links between the Homestead Agroforestry Research and Extension Project, the S&T funded Forestry/Fuelwood Research and Development Project (F/FRED) specially the Asia component of the Project, and the International Council for Research in Agroforestry (ICRAF).

We envision a close collaboration with ICRAF and will draw upon their International expertise in agroforestry. ICRAF and this Project will collaborate in carrying out research for development of location specific agroforestry technologies. In addition, ICRAF will provide training for Bangladeshi scientists and synthesize information relevant to agroforestry and disseminate this information to scientists and planners.

The F/FRED Project was developed in response to documented fuelwood needs in developing countries and to the identification of LDC fuelwood research needs in the Asia region. The F/FRED Project will:

o Research Policy, Planning and Management: Assist host countries in developing country specific national fuelwood/forestry policies, plans and programs; provide training and other assistance to strengthen key LDC institutions to carry out national forestry/fuelwood research and development plans, and development information systems in support of multi-purpose tree research in Asia.

o Network Development and Research: Improve research methods and information management; development and monitor agreed upon collaborative research programs across Asia; conduct workshops and conferences for networks; purchase commodities required for research management and support for publication of results; supply expertise, mostly short-term, to host countries to assist them in project design and management; fuelwood research assessments; appraisals and evaluations of research activities, needs, etc; and behavioral, institutional and human resource evaluation.

o Global Research: Develop state-of-the art papers and other technology assessments; develop research methodologies (e.g. models) as a basis for integrating, structuring, and disseminating currently available information; use research methodologies (e.g. models) to evaluate fuelwood/multipurpose tree species as components of agroforestry or other farming systems approaches to define new research needs.

### Project Rationale

The goal of the Project is increase rural incomes through greater production of fuel, fodder, construction and handicraft supplies, and food on privately held homestead land.

The BDG and several donors have been increasing the level of resources available for forest resources production. Large scale programs are underway to develop mangrove forests on lands newly formed in the Bay of Bengal. Efforts are being made to increase production from the Chittagong Hill Tracts and other forest reserves. Strip plantations are being attempted along public roads, railway beds, and canal embankments. Until now, only limited measures have been taken to increase forestry production on the nation's rural homesteads. The major reason is that until very recently the country's forestry institutions had little they could offer small farmers in terms of improved varieties or cultivation techniques.

Some beginnings, however, have been made in changing this situation. Forestry research priorities have begun to shift toward areas of more direct relevance to small farmers. The various extension services are beginning to include forestry matters in the messages they carry. This Project should accelerate and expand this process, as its purpose is to strengthen the capability of the MAF to assist the nation's farm families to increase significantly their homestead production of, and enhance their returns from the cultivation of trees, bamboos, woody shrubs, and groundcovers. At present, agroforestry research and extension capabilities require strengthening, and both will be addressed in this Project.

## Project Elements

Figure 1 indicates the major responsibilities of Project administrative units and interactions among them. Project "logic" can be most usefully revealed by examining separate elements within the Project: 1) Research and Extension, 2) Training, and 3) Resource Management.

### Research/Extension

Specific tasks to be accomplished in order to enhance the capacity of the MAF to carry out effective research and extension work in Homestead Agroforestry include:

Establishment of a new Agroforestry Research Cell within the Forest Management Research Branch (FMERB) of FRI. This new unit will develop its own research program and carry out a variety of liaison and coordination tasks. Specifically, it will compile information (including research reports) on all agroforestry related research done at FRI and other research institutions. In the future it will act, in conjunction with BARC, as a clearinghouse for all agroforestry research done in Bangladesh, and as a depository for agroforestry research done abroad. The Agroforestry Research Cell will, in conjunction with BARC and the Planning Commission, lead other MAF research organizations in setting a new agenda for agroforestry research in Bangladesh, and publicize it as appropriate.

A major task of FRI will be scientific support of the work of Homestead Agroforestry Teams (HAT) at the Farming Systems Sites. FRI staff (in the Agroforestry Research Cell and other units) will carry out laboratory work on the FRI campus and field trials on Silviculture Research Stations (SRS) at Keochia, Charaljani, Charkai, and Lawachara. Furthermore, FRI scientists will advise AFSSOs at HATs on selection of field trials for the FSSs.

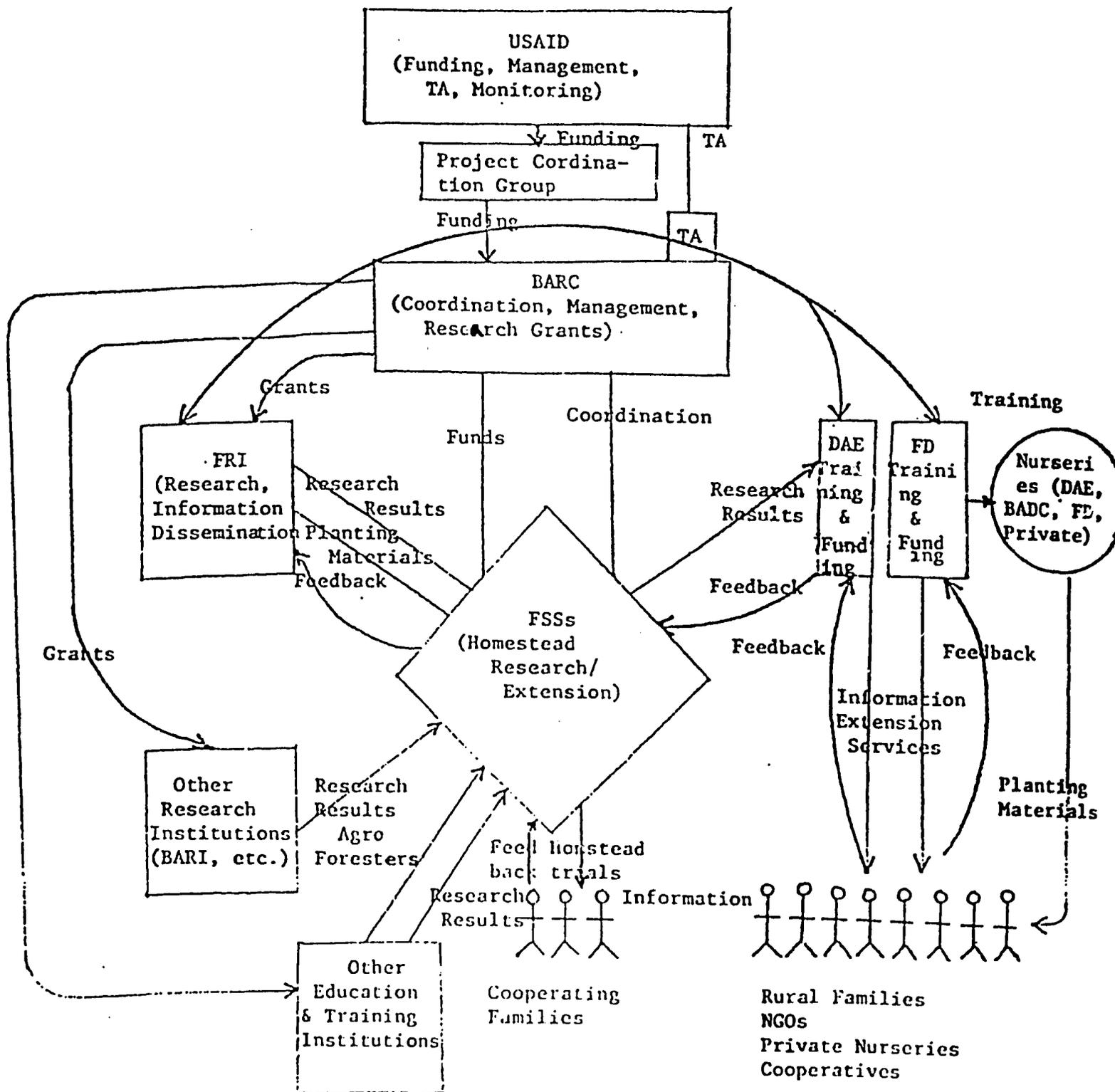
The FRI Agroforestry Research Cell will facilitate a two-way exchange of information and planting material between SRSs and FSSs (as well as among these units, BARC, and FRI headquarters). FSS personnel will report on rural residents' needs, problems, successes, and failures in homestead agroforestry production. FRI researchers will design and modify their research activities accordingly. Experiments carried out by HAT researchers will reflect local needs and concerns. By the Project's midpoint (late 1989) new research experiments and trials will be initiated at FRI and FSS at rates, respectively, of 10-15 per year.

Because some relevant research on appropriate tree, shrub, bamboo, and forage species has already been done at FRI and the SRSs, it will not be necessary to wait for results of future FRI research to initiate homestead trials under the Project. Some testing can begin at FSSs soon after agroforesters are established in the field. Some 15-20 proven species/provenances which hold excellent promise for various areas of Bangladesh have already been identified and are



FIGURE 1

PROJECT ELEMENTS AND ORGANIZATION



25

immediately available for homestead trials. These include: trees - two species of Acacia, two species of Leucaena (ipil-ipil), three species of Casuarina, and one Melaleuca; leguminous groundcovers - four cultivars of Stylosanthes and two cultivars of Dolichos; woody shrubs - Tephrosia candida and Cajanus cajan; and bamboos - Bambusa untans, and B. vulgaris.

BARC will (through the Member-Director for Forestry) take general responsibility for Project direction and coordination. Specific tasks include: 1) overall financial management, 2) introduction of HATs into the FSSs and coordination after they are established, 3) administration of two Agroforestry Research Funds, and 4) inter-institutional coordination of research, extension and training, and 5) liaison with the TA Team.

Actual physical establishment of HATs will take place on a phased basis. The first 5-6 units will be introduced into appropriate FSSs in October, 1987. The remaining 16-17 HATs will be phased in to FSSs by 1991. It must be noted that it is somewhat premature to refer to the research sites discussed here as "farming system" sites because research carried out at the sites does not yet meet all methodological criteria implied by the term. What each of the sites does provide is a network of more or less typical Bangladeshi farmers on whose farms research is conducted with village-level management practices and inputs. It is an MAF goal that, ultimately, "farming systems" research be carried out at these sites. Substantial progress is being made toward that goal. In fact, this Project (as well as the ADB Livestock Project) will play a key role in broadening the agenda of these institutions from cropping systems to farming systems.

BARC will also administer (according to procedures already established) two contract research funds earmarked for support of work in Homestead Agroforestry. The larger (\$1.0 million) fund will support laboratory and station research, while the smaller (\$400,000) fund will support social research and experimental field efforts to introduce agroforestry to rural Bangladesh. Scientists in BDG research institutes and universities will be supported under the former program, while both BDG institutions and NGOs will be funded under the latter. One half of the latter fund (for experiments in introducing agroforestry practices) will be earmarked for NGOs.

Contract research funds will be included as part of the TA contract and will be granted to researchers under BARC supervision. Procedures for research grant selection, disbursement and accounting will be identical to those applied under USAID's Agricultural Research II Project.

As experiments and trials progress at FSSs, and promising species and cultivation practices are identified, these will be reported to the DAE in the form of detailed, useable recommendations, which can be transmitted to farmers through the already established and functioning Training and Visit system of the DAE.

The DAE Training Division (assisted by the Training Advisor I from the TA Team), will be responsible for establishing an Agrofores-

try Extension Cell that will develop and implement training courses in agroforestry for MAF personnel who will do essential agroforestry research and extension work. Training activities that will be required include:

- o Special orientation lectures on Homestead Agroforestry to be provided to several thousand Block Supervisors during fortnightly training sessions under the Training and Visit System.

- o A brief module on Basic Concepts and Methods of Agroforestry to be introduced into the two year basic training course for Block Supervisors offered at seven ATIs, and the one year in-service course offered to veteran Block Supervisors at the four remaining ATIs.

- o A variety of promotional seminars spreading the message regarding potential economic returns to homestead agroforestry.

- o As research proceeds at FRI and the FSSs, and specific new practices reach the recommendation stage, carefully designed "technology workshops" will introduce new species, varieties, cultivation techniques, and management methods to interested audiences. These workshops will have a strong "hands-on" orientation, and will be offered to SMOs, SMSs, UKOs, Block Supervisors, NGO employees, and private sector nursery operators/supervisors.

The DAE Training Division will also oversee development of films, radio spots, slide shows, posters, leaflets, etc. for promotion of Homestead Agroforestry in general, and for making rural people aware of specific new technologies.

The Forest Academy (assisted by the Training Advisor II) will be responsible for:

- o A Six Month Agroforestry Course for 20-30 Forestry and Agriculture graduates will staff HATs at the FSSs. Ten to fifteen current employees who will serve as agroforestry instructors within the ATIs, and 15-20 FD employees will be trained as Subject Matter Officers (SMOs) in Agroforestry. The course will be offered three-four times during 1988-90.

- o Modification of curricula and preparation of educational materials (slide collections, laboratory manuals, field guides, etc.) for use in other educational institutions.

The research/extension process will require frequent, detailed coordination among research scientists, Agroforestry Scientific Officer (AFSOs) at the FSSs, and extension officials. Project funds will support travel by senior officials to quarterly coordination meetings. BARC, FRI, DAE and FD will be represented under the sponsorship of the Joint Secretary for Agriculture. Representative scientists, AFSOs, and SMSs will attend meetings of a research steering committee, which will also include representatives from BARC, FRI, DAE, and FD. The Project will support sufficient travel and meetings to facilitate "self-coordination" and timely information exchange among researchers, extension officers, and rural residents. Senior

officials will need to be tolerant of frequent, unsupervised interactions among their subordinates, and BDG employees at all levels must cultivate listening skills. AFSOs and Field Assistants must listen to cooperating families and be prepared to pass their reactions (largely uncensored) along to BARC and FRI officials. The reactions and preferences of both sexes need to be solicited when talking to cooperating families. Research scientists should listen to extension officials and even actively seek their guidance in designing field trials.

Both existing projects, and possible future programs (e.g. in agroforestry/resettlement of denuded hills in Chittagong and the Hill Tracts; stabilization of the Sal Forest of Tangail-Dhaka-Mymensingh; and protection of the Sundarbans Forest) will create a large demand for agriculturists and foresters trained in agroforestry. In order to provide a partial solution to future demand, the Project will support development of a wide range of curriculum and training materials which can be adopted by interested educational institutions.

It should be noted that, although the Project will rely primarily on the DAE to transmit promising research results to farmers, planting recommendations will also be transmitted to NGOs working in agricultural extension. We also anticipate that, in some instances, the demonstration effects of successful homestead trials at FSSs will lead to substantial adoption of new species and cultivation practices by neighboring families.

### Training

The Project will support several training activities.

1) A Pre-implementation Phase - A number of mid-level professionals—FRI scientists, university researchers, and other MAF officials will be given support to attend a variety of conferences, workshops and study tours. Attendees will: learn more about the basic concepts and methods of agroforestry; gain exposure to research and researchers in other countries; and be motivated to re-orient their own work so that it is more relevant to agroforestry. Those who attend international conferences or workshops will be required to report their experiences at in-country workshops.

2) The Six Month Agroforestry Course (SMAC) - This course will provide a major focus for the TA Training Advisor for two years after his or her arrival. He or she will cooperate with Forest Academy instructors and with DAE, FRI, BARC, and university officials in designing and implementing the Six Month Course. Trainees will be recent forestry and agriculture graduates who will serve as AFSOs (at the FSSs), AFI instructors, or Forest Department SMSs after successful course completion. The SMAC will be offered at the Forest Academy, and managed by faculty members with the advice and support of the Training Advisor. FRI, DAE, BARC and university employees will serve as temporary instructors, and will be given honoraria in proportion to their teaching responsibilities. The Course will place strong emphasis on fieldwork and hands-on skills training.

3) Long-Term and Medium-Term Training - Ten to twelve MAF officials will be provided with M.S or Ph.D. training in fields specifically required for support of agroforestry research and extension in Bangladesh. U.S. and third country universities will be selected, as appropriate. In addition, eight to ten researchers will be sent as Research Associates to the International Centre for Research on Agroforestry in Nairobi.

4) Curriculum Development - The other Training Advisor will be involved in the design of a Homestead Agroforestry training module to be introduced into orientation and in-service training for Block Supervisors at the ATIs. Finally, he or she will assist officials in other training and education institutions (e.g. FD training institutions and universities) to adapt available materials to use in those institutions.

5) Technology Workshops - Workshops will be designed to introduce promising new technologies. These Homestead Agroforestry Technology Workshops will be presented to the widest possible audience -- DAE employees including SMOs, SMSs, UKOs, male and female Block Supervisors; community workers of the Bangladesh Rural Development Board (BRDB) and members of BRDB sponsored cooperatives; NGO employees and the rural groups with which they work; nursery operators; and ordinary rural residents of both sexes.

#### Administration of Project Resources

Project resources will be coordinated by BARC and funds will be disbursed through the TA Contract. BARC managed USAID funds will directly support Homestead Agroforestry Teams at the Farming Systems Sites and two Agroforestry Contract Research Funds. BARC will cooperate with the USAID Training Office and cooperating MAF institutions in selecting long, medium, and short-term trainees (largely from FRI, DAE, BARC, and the universities). A procurement unit provided under the TA contract, will act as the intermediary between FRI and participating institutions in compiling annual orders for equipment and commodities. Funds for core research at FRI and training/extension activities within DAE and other institutions will come under the oversight of BARC.

#### Relationship to Other Projects

During implementation, the Homestead Agroforestry Research and Extension Project must be carefully coordinated with three other activities -- USAID's Agricultural Research II Project, ADB's Community Forestry Project and the World Bank's Forestry Projects.

Agricultural Research II will soon be extended for four additional years, to June 1991. A sizeable TA team will continue to work at BARC, BARI, and BRRI in enhancing the institutional capacity of

particular institutions and improving coordination among all of them. During the four year extension period (June, 1987-June, 1991) the Project will place increasing emphasis on upgrading and expanding the national system of Farming Systems Sites. It is inevitable that there will be areas of overlap between the two USAID Projects and their respective TA teams. However, since the two Projects will have a single USAID Project Manager, overlap and friction can be minimized.

From the beginning, USAID's Homestead Agroforestry Project has been designed to complement ADB's Community Forestry Project\*. Areas of complementarity include.

Homestead Agroforestry (AID)

Will emphasize institution building within the DAE.

Will strengthen research capacity at FRI and the FSSs.

Will work with existing nurseries and those established under other projects.

Places major emphasis on tree/shrub/bamboo production on private homestead land

Will support general curriculum development in Agroforestry for introduction into a number of interested education and training institutions.

Community Forestry (ADB)

Emphasizes institution building within the Directorate of Forestry Extension.

Places immediate emphasis on seedling distribution and motivation.

Upgrades present nurseries and establishes new zila nurseries.

Emphasizes block plantations on Forest Development land and strip plantations on road, canal, and railway rights of way.

Will introduce Community Forestry techniques into the curriculum of one Forest Department training institution in Rajshahi.

BDG officials and TA advisors involved with the USAID and ADB Projects will meet frequently to exchange information and define areas for cooperation. Since both projects are under the direction of a single Joint Secretary of Agriculture, smooth coordination can be anticipated. USAID is open to formation of a formal Coordinating Committee under the direction of the Secretary or Joint Secretary for Agriculture and Forests.

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\* The second phase of the ADB Project is under design. Project emphasis will change somewhat but not enough to disturb the essential complementarity of the two Projects.

**COST ESTIMATE AND FINANCIAL PLAN**

TABLE 1

AID CONTRIBUTION  
( \$000 )

<b>I. <u>Pre-implementation Stage</u> (\$300)</b>		
A. International Conferences, Local Workshops and Study Tours		\$ 140
B. Research Associateship		30
C. Degree Training		100
D. ICRAF Consultancy (FRI, DAE, Universities)		30
<b>II. <u>Full Implementation Stage</u></b>		
A. <u>TA Team</u> (\$6,600 approved-30% Overhead Incorporated)		
1) Long-term (300 PM)		\$ 4,825
2) Short-term (80 PM)		1,575
3) Local Consultants (100 PM)		200
B. <u>Training</u> (\$1,040)		
1) BARC -		
a) Long-term (1 Ph.D, 1 MS, 1 Research Assoc)		170
b) Short-term (10 PM)		40
2) FRI -		
a) Long-term (1 Ph.D, 2 MS, 3 Research Assoc)		\$ 270
b) Short-term (15 PM)		60
3) FD -		
a) Long-term (1 Ph.D, 2 MS, 2 Research Assoc)		240
b) Short-term (15 PM)		60
4) DAE -		
a) Long-term (2 MS, 1 Research Assoc)		120
b) Short-term (20 PM)		80
C. <u>Equipment/Commodities/Vehicles</u> (\$745)		
1) BARC -		
a) Vehicles (2 Jeeps)		45
b) Vehicle Operation and Maintenance		10
c) Book Collection		30

2) FRI -	
a) Vehicles (4 Jeeps, 2 Vans)	\$ 110
b) 25 Motorcycles, 100 Bicycles	40
c) Vehicle Operation and Maintenance	40
d) Laboratory Equipment and Materials	125
e) Book Collection and Journals	25
3) FD -	
a) Vehicles (2 Vans, 2 Coasters)	80
b) Vehicle Operation and Maintenance	20
c) Educational Equipment (Incl. Book Collection)	60
4) DAE -	
a) Vehicles (2 Vans, 2 Coaster)	80
b) Vehicle Operation and Maintenance	20
c) Educ. Equipment (Incl. Book Collections)	60
D. <u>Research/Extension Support</u> (\$3,000)	
1) BARC -	
a) Contract Research Fund for Laboratory & Field Research in AF (Approx. 100 Grants at \$10,000 each)	\$ 1,000
b) Contract Research Fund for Application of AF Techniques in Rural Bangladesh (Approx. 40 Grants at \$10,000 each)	400
c) BARC-Sponsored Workshops/Seminars	100
d) Operation of FSS Facilities, Modest Equipment Approx. \$2500/Station/Year)	150
e) Process Observation	100
f) Support for Seedling Supplies	50
g) Evaluation (Including a Pesticide Study, if Required)	225
2) FRI -	
a) For Support BAF Assoc. & Publications	50
b) Core Research Budget	350
c) Establishment and Operation of a FSS in the "Denuded Hills" of Chittagong	50
d) For Salaries and Benefits of Field Assistants at FSSs. (300 Person Years at Tk. 30,000 Per Year)	300
3) FD -	
a) Per Diem and Honoraria for Trainers	75

4) DAE	
a) Field Days and Tours	100
b) Per Diem & Honoraria for Trainers	50
Subtotal	<hr/> \$ 11,685
III. <u>Contingency (5% Simple for \$ Costs,</u>	
<u>10% Compounded for Tk. Costs) and Inflation</u>	2,815
<u>(5% Simple)</u>	
TOTAL AID CONTRIBUTION	\$ 14,500

BDG CONTRIBUTION (\$1=Tk. 30)

I. Salaries and Overhead (Professionals receive annual salaries and benefits of approx. Tk. 60,000, support staff receive approx. Tk. 30,000) (Tk. 19,160,000; \$638,700).

- |  |                             |
|--|-----------------------------|
| 1) FRI - New and transferred prof. staff - 40 person years. New and transferred support staff 60 person years. Plus 40% overhead. Head office and SRSs.  | Tk.5,880,000<br>(\$196,000) |
| 2) EDUCATION/TRAINING INSTITUTIONS - New and transferred prof. staff 12 person years, Plus 40% overhead.   | Tk.1,080,000<br>(\$36,000)  |
| 3) DAE - New and transferred prof.staff - 60 person years. New and transferred support staff - 20 person years. Plus 40% overhead. Head office and ATIs. | Tk.5,880,000<br>(\$196,000) |
| 4) BARC- New and transferred prof.staff - 20 person years. New and transferred support staff - 20 person years. Plus 40% overhead.                       | Tk.1,520,000<br>(\$ 51,000) |
| 5) HATs- New and transferred prof. staff - 80 person years.  | Tk.4,800,000<br>(\$160,000) |

II. Vehicle Operation\* (Vehicle operation - 15,000 miles/year and Tk.8/mile Motorcycle operation-10,000 miles/year and Tk.1/mile) Tk.8,400,000; \$280,000)

- |   |                             |
|---|-----------------------------|
| 1) FRI - (Approx. 16 vehicle years)                             | Tk.1,920,000<br>(\$ 64,000) |
| 2) Education/Training Institutions - (Approx. 14 vehicle years) | Tk.1,680,000<br>(\$ 56,000) |
| 3) DAE - (Approx. 24 vehicle years)                             | Tk.2,880,000<br>(\$ 96,000) |
| 4) BARC- (Approx. 8 vehicle years)                              | Tk. 960,000<br>(\$ 32,000)  |
| 5) HATs- (Approx. 96 motorcycle years)                          | Tk. 960,000<br>(\$ 32,000)  |

\* Appropriate vehicles will be made available to long-term and short-term TA advisors when they are serving at MAF institutions. While the vehicles are under the control of TA advisors, fuel and maintenance costs will be paid from Project funds. When they are under control of MAF officials, the appropriate institution will pay for fuel and maintenance.

<b>III. <u>Research Expenses</u> (Tk. 14,700,000; \$490,000)</b>	
1) Core research at FRI-(Ascending shares--25, 50, 75, and 80%--in last four years)	Tk. 4,800,000 (\$160,000)
2) Contract research fund-(Ascending shares--10, 20, 30, 40%--in last four years)	Tk. 9,900,000 (\$330,000)
<b>IV. <u>Administration</u> (Tk. 6,000,000; \$200,000)</b>	
1) Administrative cost of selecting and approving trainees	Tk. 3,000,000 (\$100,000)
2) Indirect Project administrative costs--high level meetings, PP approval, etc. MAF, Planning Commission, External Resources Division	Tk. 3,000,000 (\$100,000)
Subtotal	Tk.48,260,000 (\$1,609,000)
<b>V. <u>Contingency (5%) and Inflation (10% compounded)</u></b>	<b>Tk.26,740,000</b> <b>(\$ 891,000)</b>
<b>TOTAL BDG CONTRIBUTION</b>	<b>Tk.75,000,000</b> <b>(\$2,500,000)</b>

TABLE 3

CONTRIBUTION OF US GOVERNMENT BY US FISCAL YEAR  
( \$ 000)

Expenditure Category	FY 86		FY 87		FY 88		FY 89		FY 90		FY 91		FY 92		FY 93		Column Total
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC			
<u>Preparatory Stage</u>	120	150	10	20													300
A. TA Team				250		1,750		1,750			1,500		1,000		350		6,600
B. Training		160		250		250		150		130		100					1,040
C. Equipment, Commodities, Vehicles		75		200	25	100	25	150	25	50	25	50	20				745
D. Research/Extension			20	50	375	75	475	50	525		550	25	460	20	375		3,000
	120-	385	30	770	400	2,175	500	2,100	550	1,680	575	1,175	480	370	375		
Subtotal	120	415		1170		2675		2650		2255		1655		745			11,685
I. Inflation (5% simple for \$ costs, 10% compounded for Tk. costs)			22		120		284		360		427		428		375		2,016
. Contingency (5%),	6	45		75		165		170		145		125		68			799
Row Total	126	482		1365		3124		3180		2827		2208		1188			GRAND TOTAL 14,500

TABLE 3

CONTRIBUTION OF US GOVERNMENT BY US FISCAL YEAR  
(\$ 000)

Expenditure Category	FY 86		FY 87		FY 88		FY 89		FY 90		FY 91		FY 92		FY 93		Column Total
	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	FX	LC	
I. <u>Preparatory Stage</u>	120	150	10	20													3
II. A. TA Team				250		1,750		1,750		1,500		1,000		350			6,6
B. Training		160		250		250		150		130		100					1,0
C. Equipment, Commodities, Vehicles		75		200	25	100	25	150	25	50	25	50	20				7
D. Research/Extension			20	50	375	75	475	50	525		550	25	460	20	375		3,0
Subtotal	120-	385	30	770	400	2,175	500	2,100	550	1,680	575	1,175	480	370	375		11,6
III. Inflation (5% simple for \$ costs, 10% compounded for Tk. costs)			22		120		284		360		427		428		375		2,0
IV. Contingency (5%),	6		45		75		165		170		145		125		68		7
Row Total	126	482		1365		3124		3180		2827		2208		1188		<b>GRAND TOTAL</b>	14,5

TABLE 4

## CONTRIBUTION OF BANGLADESH GOVERNMENT BY BDG FISCAL YEAR

(\$ 000)

Expenditure Category	FY 86-87	FY 87-88	FY 88-89	FY 89-90	FY 90-91	FY 91-92	FY 92-93	Column Total
I. Salaries & Overhead	19	60	80	120	120	120	120	639
II. Vehicle Operation	-	25	35	50	50	60	60	280
III. Research Expenses	-	-	-	49	98	147	196	490
IV. Administration	30	30	30	30	30	30	20	200
Subtotal	49	115	145	249	298	357	396	1609
V. Inflation (10% compounded)	-	12	30	82	137	218	305	784
VI. Contingency (5%)	2	5	8	14	20	26	32	107
Row Total	51	132	183	345	455	601	733	GRAND TOTAL 2,500

## IMPLEMENTATION PLAN

USAID management responsibilities will vary significantly over four Project phases--design, preparation, full implementation, and termination as described on pages 40 & 41. Incumbent Project Officers will have substantial organizational responsibilities in the final stages of design (April - June, 1986) and during the preparation phase (July, 1986-August, 1987). With arrival of the TA advisor team in November, 1987 his or her responsibilities will be no less time consuming, but will shift from direct implementation to day-to-day monitoring and intermittent evaluation. From September, 1987 until September 1993, direct responsibility for implementation of agroforestry research, training, and extension activities will rest with officials of several MAF organizations who will be advised by members of the TA Team. Specific responsibilities are discussed below.

### TA Team Composition and Management Responsibilities

The team will provide approximately 300 person-months of advisory assistance. A seven person team will be required for individual periods of three to five years. Five advisors will arrive between November, 1987 and January, 1988 and two more will arrive six months to a year later. All seven team members will be in-country for one year, and then team size will decline to six, three, and one full-time advisors at intervals up to 1992. (See Figure 2)

The team will include:

- 1) An Agroforestry Advisor with extensive experience in agroforestry research and extension, who will be located at BARC and serve as Chief of Party. The Agroforestry/Chief of Party's counterpart will be the BARC Member-Director for Forestry.
- 2) An Agroforestry Research Advisor to be located at FRI Chittagong to assist in selection of topics, organization of component technology experiments at Silviculture Research Stations, and advise on design of homestead trials for FSSs. The Agroforestry Research Advisor's Counterpart will be the Chief of the Agroforestry Division at FRI.
- 3) An Agroforestry Economics Advisor who will assist in establishment of a system for economic analysis of Homestead Agroforestry production systems within the Forest Economics Division at FRI. The Agroforestry Economics Advisor's counterpart will be the Chief of the Agricultural Economics Division at FRI.
- 4) A Farming Systems Research Advisor who will be attached to BARC and have major responsibility for coordination of Homestead Agroforestry activities at the FSS. The Farming Systems Research Advisor's counterpart will be the coordinator of farming systems activities at BARC.

FIGURE 2

SCHEDULE OF MAJOR PROJECT EVENTS

Activity and Sub-activity	Date									
	CY '86	CY '87	CY '88	CY '89	CY '90	CY '91	CY '92	CY '93	CY '94	
J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D   J F M A M J J A S O N D										
<b>1. DESIGN, IMPLEMENTATION AND EVALUATION</b>										
o Project Design										
o USAID Authorization	X X									
o BDB PP Approval	XX									
o Project Agreement	XX									
o Project Implementation Workshop	X									
o Implementation Assess.			--		--					
o Impact Evaluation						--		--		
o Re-Design			X			X		X		
o PACD								X		
o Design of Follow-on									X	
o Annual Procurement		--	--	--	--	--	--	--		
<b>2. PRE-PROJECT IMPLEMENTATION</b>										
o AF Conferences/Workshops		XXX	XXX							
o Research Associateship		-----	-----							
o Degree Training		-----	-----							
o ICRAF Advisors	--		--							

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CY '86      CY '87      CY '88      CY '89      CY '90      CY '91      CY '92      CY '93      CY '94

	JFMAMJJASON							
<b>3. TECHNICAL ASSISTANCE TEAM</b>								
o RFP	X							
o Contract Signed		X						
o Agroforester/Team Leader (60 mos)			-----	-----	-----	-----		
o Agroforestry Research Specialist (36 mos)			-----	-----	-----			
o Forest Economist (36 mos)			-----	-----	-----			
o AF Training Specialist I (36 mos)			-----	-----	-----			
o AF Curriculum specialist (24 mos)			-----	-----	-----			
o Seedling PDM Spec. (48 mos)				-----	-----	-----		
o Farming Systems Adv. (36 mos)				-----	-----	-----		
o Short-Term TA			-----	-----	-----	-----		
<b>4. TRAINING &amp; EDUCATION</b>								
o Degree Training		-----	-----	-----	-----	-----		
o Training for AFSOs			-----	-----				
o Training for FFS-FAs			-----	-----				
o Training for: FRSs, SMSs, SMSs, UKDs, NGO'l			-----	-----	-----	-----		
o Training for BSs					-----	-----	-----	
o Training for Businessmen, Paraprofessionals, Farmers (at UTC)					-----	-----	-----	
o Training for Senior Officials			X	X	X	X		

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CY '86

CY '87

CY '88

CY '89

CY '90

CY '91

CY '92

CY '93

CY '94

JFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASONDJFMAMJJASON										
<b>5. RESEARCH &amp; EXTENSION</b>										
o Annual Equipment Lists Prepared		---	---	---	---					
o FRI-Core Research Program										
o BARC--Contract Research RFPs		X	X	X	X	X	X	X	X	X
o BARC--Contract Research Awards		X	X	X	X	X	X	X	X	X
o Contract Res. in AF										
o AF at First 6 FSSs										
o AF at Remaining FSSs										
o Trials Planted at FSSs		--	--	--	--	--	--	--	--	--
o Voluntary Adoption of AF Practices by Rural Families										
o Planting of Nursery Stock for Later Years		--	--	--	--	--	--	--	--	--

5) An Agroforestry Training Advisor (designated "Training Advisor I") will initially advise a Bangladeshi team responsible for design and implementation of a new Agroforestry curriculum for DAE employees who enroll in orientation courses at the ATIs. Later, this Advisor will assist in designing courses and workshops for rural families, NGO representatives, and private sector nursing operators. The Training Advisor I will have the Director of the DAE Training Division as counterpart.

6) A second Agroforestry Training Advisor (designated "Training Advisor II") will assist in developing the SMAC and then assist training and education institutions in designing curricula and training materials. The Agroforestry Training Advisor II will have the Director of the Forest Academy as counterpart.

7) A Seedling Dissemination Advisor will monitor Homestead Agroforestry research and expedite introduction of appropriate seed and seedling materials into public and private sector distribution systems. The Seedling Dissemination Advisor will establish a close working relationship with directors of nursery operations at DAE, FD, and BADC. The Seedling Dissemination Advisor's counterpart will be the Chief of the Agroforestry Division at FRI.

In addition to full-time advisors, the TA team will provide approximately 80 person-months of expatriate short term technical assistance and 100 person months of short term technical assistance from local consultants. This will include: individuals with specialized knowledge of particular species (who will trouble-shoot special research problems as they arise); trainers who will be responsible for developing and presenting specific course modules; specialists in mass communications and advertising, who will develop radio spots and other means of promoting homestead agroforestry practices; computer programmers; etc.

#### Participating MAF Organizations and Their Responsibilities

Project TA and financial resources will be provided through BARC to enable it to coordinate more effectively Agroforestry Research in other organizations, to introduce Homestead Agroforestry research into the FSSs, and to administer two Agroforestry contract research programs. TA Advisors will be placed full-time in four institutions and part-time in others. However, all long term and short term advisors will receive administrative support from a Project Management Unit at BARC, and will be under the supervisory control of the Chief of Party and his or her counterpart.

o Additional funding will be passed through BARC to FRI to enable it to expand and accelerate research on management systems and component technologies essential for effective Homestead Agroforestry practices by Bangladeshi rural families.

o Additional funding will be passed through BARC to DAE to introduce Agroforestry Training Modules into orientation and in-service training at the ATIs, and provide through the Training and

Visit System, workshops at Upazilla Training Centers, mobile training teams, etc.--specific information on promising technologies to rural families, NGOs, nursery operators and technicians, etc.

- o Funding will be passed through BARC to DAE for support of the Six Month Agroforestry Course and other training activities.

- o Additional funding may be passed to education and training institutions to enable them to establish both classroom and field-oriented programs in agroforestry.

Relationships among the MAF organizations, USAID, and the FSSs are indicated in Figure 1.

#### Bangladesh Agricultural Research Council

BARC will be responsible for overall Project coordination and management. Specifically, BARC officials (with advice and assistance from the TA team) will:

- o Coordinate introduction of Homestead Agroforestry Teams (HAT) into the national network of Farming System Sites (FSSs). They will administer the modest funds required at FSSs for: renting additional office space; providing tools, seedling stock and inputs to cooperating families; purchase of agricultural implements and measuring instruments; office furniture and supplies; bicycles for Agroforestry Field Assistants (AFAs); and motorcycles for AFSUs. A BARC Field Coordinator (advised by the Farming Systems Research Advisor of the TA team) will coordinate activities of the HATs with FRI officials and provide organizational support for all committee activities associated with the Project.

- o Disburse funds through the TA Contract to other organizations for "core" activities. FRI core agroforestry research program requires support for laboratory equipment, research commodities, books and journals, training of scientists, operating expenses for the Agroforestry Association and associated publication program, etc. The DAE's Agroforestry Extension/Training Program requires support for vehicles, audiovisual equipment, classroom commodities books, training of trainers, per diem for government and private sector trainees, etc. Support to education and training institutions will be earmarked for vehicles, laboratory equipment, books and journals, research commodities, etc.

- o Administer a contract research program for laboratory and field research in agroforestry. Research on both "component technologies" and "homestead agroforestry production systems" will be funded. Applicants will be researchers in MAF departments and research institutes, and Bangladeshi universities.

- o Administer a second contract research program for experiments in introduction of Homestead Agroforestry to rural Bangladesh. Applicants will be MAF departments and research institutes, Bangladeshi universities, and selected NGOs.

- o Administer a fund for: 1) support of international travel and attendance at seminars, workshops, and professional meetings by agroforesters employed at BARC, FRI, DAE and other relevant institutions. 2) organization of agroforestry seminars at the same institutions, and 3) support for travel of international agroforestry experts invited to visit Bangladesh for seminar presentations.

- o As trials progress at the FSSs, and promising species and cultivation practices are identified, researchers will report these findings to DAE for transmission through workshops, training sessions and the already-established Training and Visit System.

USAID will support BARC with two TA Advisors and approximately 10 person months of short term consulting services. Financial assistance will support HATs at the FSSs, two contract research funds, and a seminar/travel fund. BARC will provide office space and administrative support for two members of the TA advisor team, and create and fill positions for, one coordinator to liaise with other institutions and provide administrative support for committee activities associated with the Project.

#### Forest Research Institute

FRI will serve as the major research institution under the Project. Specifically, FRI officials will:

- o Establish an Agroforestry Research Cell within the Forest Research Management Branch which will carry out laboratory and station research in Homestead Agroforestry at the Chittagong headquarters and four silviculture research stations; coordinate and document related research in other FRI Divisions; and supply appropriate plant materials and scientific advice to the HATs.

- o Consult with the TA advisor, BARC, DAE, and rural residents in designing homestead trials for the FSSs. Trials will be carried out by AFSOs with the assistance of AFAs. Trials will include new and improved species, provenances, species combinations, inputs, cultural practices, and management techniques.

- o Provide Field Coordinators (ultimately 3-4) to advise and supervise HATs at FSSs and provide liaison between the latter and researchers at FRI and elsewhere.

- o Assess the economic feasibility of new technologies before homestead trials begin, and monitor economic returns as trials proceed.

- o Establish an additional Farming Systems Site within the denuded hills of Chittagong, which will treat the problems of both lowland and upland agriculture; will place particular emphasis on Homestead Agroforestry, but will also carry out work on field crops, livestock, economics, etc.

o In addition to carrying out the core research program in agroforestry, apply to BARC for additional funding of contract research as promising additional topics are identified by scientists and research units.

o Provide an institutional home for a new professional organization--the Bangladesh Agroforestry Association. Host annual meetings and special seminars. Edit and publish a newsletter and occasional paper series in agroforestry. (TA Advisor will assist in establishing these activities. Project funds will provide initial support for the Agroforestry Association and publication series.)

USAID will provide three TA advisors and approximately 15 person months of short term consulting services. Scientists will be trained in the U.S. or third countries. Commodities and equipment will be provided and the Agroforestry Association will be supported. In return, FRI will provide office space and administrative support for two members of the TA team. Furthermore, they will recruit or reassign three to five scientists (including at least one Agroforestry Economist) and appropriate support staff to work in the Agroforestry Research Cell.

#### Forest Department

FD will play a significant role in the Project, particularly in provision of training and extension services. A member of the TA Team, the Agroforestry Curriculum Development Specialist, will be assigned to work with FD. He or she will cooperate with the staff of the Forest Academy in designing and implementing the Six Month Agroforestry Course. The course will be offered two or three times before the end of the fourth year of the project. Enrollees in each course will consist of 6-8 employees of FRI, who will serve as AFSOs at FSSs; 6 - 8 DAE employees, will be assigned as instructors at the ATIs; and 6 - 8 FD employees, will be assigned as SMSs at the District level. Forest Academy staff will implement the Six Month Agroforestry Course (SMAC) and act as full-time instructors. Guest lecturers, with expertise in forestry, agronomy, horticulture, soil science, farming systems, social research, and other topics will be drawn from FD, FRI, BARI, BARC, the universities, and other institutions.

The Forest Department will be represented on the Project Coordination Group, a committee established for coordination of the Homestead Agroforestry (USAID) and Community Forestry (ADB) Projects, and sponsored by the Joint Secretary for Agriculture. In the later stages of the Homestead Agroforestry Project, FD will cooperate with DAE and other institutions in implementing short training courses in new agroforestry technologies. In many cases courses will be offered at FD sponsored Upazila Nurseries.

After the first session of the SMAC, the TA advisor will assist FD institutions (the Forest Academy and Forest Schools) to develop new curricula and educational materials in Agroforestry. The Homestead Agroforestry Project will provide vehicles, educational equipment, and books in support of these goals. The vehicles will be used frequently to transport FD trainees, employees of cooperating institutions (e.g.

DAE, FRI), and other trainees to field sites where appropriate forestry and agroforestry activities can be observed.

USAID will support the FD with a TA advisor and approximately 10 person months of short-term consulting services. Scientists will be trained in the U.S. or third countries. Educational equipment and vehicles will support presentation of the Six Month Agroforestry Course. The FD will provide office space and administrative support for the TA advisor, and provide sufficient staff of the Forest Academy available to support smooth operation of the SMAC.

#### Department of Agricultural Extension

DAE will be responsible for extension of technologies developed at FRI and other research institutions and successfully tested at FSSs. Specifically, DAE officials will:

- o Establish an Agroforestry Extension Cell which will disseminate knowledge of emerging Homestead Agroforestry research. Make specific recommendations on cultural practices to Block Supervisors who can in turn extend knowledge to rural families. The established system of District Technical Committees and fortnightly meetings will be supplemented by special workshops and training sessions, as necessary. The Project will rely heavily on government-extension networks, but DAE will also transmit planting recommendations to NGOs, nursery operators, and others working in agricultural extension.
- o Introduce general training in "Agroforestry Concepts and Methods" into the curriculum of the Agricultural Training Institutes and other institutions.
- o Recruit residents of FSS areas to serve as Agroforestry Field Assistants (AFA) within the HATs. Those who serve with particular distinction may be recruited later as Block Supervisors. Initially, they will serve on a temporary basis, paid from Project funds.
- o Provide training in nursery management, grafting etc. to interested private sector individuals--seedling dealers, nursery operators, etc.
- o Provide logistical support and liaison for field days and other visits to research sites (e.g. BARI, and FRI stations, FSSs) so that Block Supervisors and rural residents can observe experiments and trials first hand.

USAID will provide one TA advisor and approximately 30 person months of short term consulting services. Commodities, including vehicles textbooks, audio-visual equipment, laboratory and field equipment will be provided for the ATIs and other training activities. A fund will be created for organization of field days and research site visits (e.g. to provide extension workers with per diem and travel expenses.

## Major Contracting Activities

The major contract under the Project will be for the Advisory Team. The cost will be approximately \$6.6 million. The Mission will open contract bidding to Title XII Universities, commercial firms, and other appropriate organizations. It is unlikely that a minority firm or university firm can offer sufficient expertise to field an entire team. However, the Mission is consulting with PRE/OBR and the Agency HBCU (Historically Black College or University) Committee, and will require a joint venture or subcontracting arrangement in which at least 20% of total contracted services are provided by an HBCU, 8(a) firm, or women-controlled firm.

The contract will be advertised in October and applications will be received in late December, 1986. A draft PIO/T will be completed in December, 1986 and the final document in January, 1987. If selection of a contractor and individual advisors proceeds smoothly, the team (four-five initial members) can be expected to arrive in September, 1987.

The total quantity of vehicles, laboratory equipment, and other commodities required for the project is modest, but timely delivery is essential to project success. The selected TA contractor will be encouraged to subcontract procurement activities: they may wish to select a commercial procurement agent, or obtain the services of the procurement unit already established by Winrock International under the Agriculture Research II Project. Order lists will be submitted by participating institutions in late December each year from 1986 to 1989. Materials will be delivered by July-August of the following year.

## Major Project Events

Major events in the life of the Project are:

July, 1986	- Project Authorization.
August, 1986	- Project Agreement signed and initial disbursement.
January, 1987	- First annual cycle of commodity procurement begins.
September 1987	- TA Advisory Team arrives.
October, 1987	- Homestead Agroforestry Teams are established at 5-6 FSSs.
March, 1988	- Six Month Agroforestry Training Course begins.
November, 1988	- Training for SMOs, SMSs, UKOs, female block supervisors and others initiated.
May - June, 1989	- First homestead trials are initiated at FSSs.
May - June, 1990	- First substantial adoption of Homestead Agroforestry practices, under the influence of the Project.
October, 1992	- TA Advisory Team's work is completed
September, 1993	- Project Activity Completion Date.
June, 1994	- Terminal Disbursement Date.

A more detailed Project schedule is provided in Figure 2.

## Methods of Implementation and Financing

USAID/Dhaka will utilize the preferred AID methods of financing for payments under the Homestead Agroforestry Research and Extension Project. Technical assistance will be provided under an AID Direct Contract with direct reimbursement of expenses. USAID/Dhaka will be responsible for issuing the invitation for bid (IPB), evaluating the proposals, and negotiating the contract with the selected contract.

Procedures for obtaining locally procured technical assistance (NTE \$200,000) will be detailed through separate project implementation letters (FILs). The majority of the procurement will be implemented through AID fixed price purchase orders or personal service contracts. However, some host country contracts may be issued if a review by USAID determines the Ministry has adequate contracting procedures. Payments for services procured locally will be on a cost reimbursement basis only. Procedures for handling procurements of this nature will be detailed in the PIL.

Most commodities financed under the project will be procured under the AID direct technical assistance contract or through separate AID direct contracts. Payments will be on a direct reimbursement basis, or, if necessary, a direct letter of commitment will be issued. The technical assistance contractor and/or the project officer/contracts officer will be responsible for issuing IFBs, reviewing all tender documents received, negotiating, and signing all contracts.

Most of the training will be handled under the prime technical assistance contract and, as such, expenses will be directly reimbursed. However, prior to the arrival of the TA contractor, a number of Bangladeshi scientists, administrators and extension workers will be provided international training in agroforestry and related fields. A variety of training activities -- degree programs; research associateships; attendance at international workshops; and study tours will be supported. AID will issue invitational travel orders, PIO/Ps, purchase orders, or PIL's for in-country or third country training handled outside the technical assistance contract. Payment under these implementation mechanisms will be consistent with preferred financing methods.

Funds provided for Contract Research will be committed under the prime technical assistance contract. The host government and the technical assistance contractor will be responsible for determining the cost for developing or maintaining a particular contract research activity prior to soliciting proposals for contract research. Fixed rates for research activities will be developed and published. After developing these standards, the host government will solicit and approve all contract research proposals subject to the concurrence of the technical assistance contractor who will be responsible for disbursing funds for the research activity. It is anticipated that a modified FAR contract will be developed for the various types of research activities. The government and/or the technical assistance contractor will issue fixed price contracts to the qualified researchers/institutes. Payment to the researchers/ institutes will

be made directly to the researcher/institute by the technical assistance contractor who will then seek reimbursement from AID for the agreed upon research amount. Payments to the researchers will be made at various intervals during the research and will be based upon percentage of completion. The host government and technical assistance contractor will be responsible for reviewing requests for payment on the research contracts. The technical assistance contractor will certify that the researcher has completed X percentage of the work as well as adhering to the necessary research standards prior to disbursing funds for research. Modifications to the fixed price research contract will only be allowed if unanticipated costs arise due to under estimating the work involved in developing or maintaining a particular research activity. As such, USAID considers this a modified fixed amount reimbursement.

Funds provided for publications and reproductions will be included in the direct aid technical assistance contract. The technical assistance contractor will be responsible for reviewing research papers prepared by the agriculture research institutes and scientists in Bangladesh as well as relevant papers from U.S. and third country institutes and scientists to determine the applicability and necessity for wide-spread dissemination within Bangladesh. The technical assistance contractor will be responsible for either purchasing or reproducing the material utilizing the company's procurement policies.

Evaluations will be implemented through direct contract. USAID and/or the technical assistance contractor (if funds are committed under the prime technical assistance contract) will be responsible for issuing a PIO/T, soliciting proposals, and negotiating a contract or purchase order. Payment to the contractor will be contingent upon the implementation mechanism. If a contract is issued, payment will be made to the contractor on a reimbursement basis only. If a purchase order is issued, payment will be made as defined units of work are completed.

HARE's Methods of Implementation and Financing  
(\$000)

<u>Methods of Implementation</u>	<u>Methods of Financing</u>	<u>Amount</u>
Technical Assistance (AID Direct)	Direct Pay or Direct Reimbursement	\$ 6,600
Commodities/Equipment/Vehicles	Direct L/Com or Direct Reimbursement	745
Training - (AID Direct)	Direct L/Com or Direct Reimbursement	1,340
Research/Extension Support	Fixed Amount Reimbursement and Direct Pay/Reimbursement	3,000
Contingency/Inflation	Direct Pay or Direct Reimbursement	2,815
	<b>Total:</b>	<b>\$14,500</b>

## MONITORING PLAN

The Offices of Project Design & Engineering and Food & Agriculture will be responsible for design activities up to signing of the Project Agreement and initial disbursement in August, 1986. Responsibility will then pass to the Food & Agriculture Office. Project monitoring activities will pass through an additional three phases: Preparation, Full Implementation, and Termination.

### Design Phase (March, 1985 - December, 1986)

The Project will be authorized in July, 1986 and the Project Agreement will be signed in August, 1986. Other major activities during this period will include:

- o Regular monitoring of MAF efforts to obtain BDG approval for the Project Proforma.
- o Prepare a memo outlining training and data collection activities to be completed before arrival of the TA Advisor Team in September, 1987.
- o Prepare RFTP and submit to AID/W.
- o Prepare a draft PIO/T for the major TA contract.
- o Design and implement a Pre-Implementation Workshop.

### Preparation Phase (August, 1986 - August, 1987)

After the Office of Food & Agriculture takes responsibility for the Project, there will be a period of 12-13 months before the TA Advisor Team arrives. The major implementation responsibility during this period will be solicitation, selection, and contracting of (with SER/CM assistance) the TA team. Beyond this, it is essential to maintain "momentum" and enthusiasm in the MAF by initiating a series of overseas study tours, training, consulting, and data collection activities.

The Project Officer will:

- o With assistance from MAF and the USAID Training Office, oversee initial selection and placement of scientists, professors, trainers, and extension officials in a variety of short-term and long-term training programs in the U.S. and third countries.
- o Prepare PIO/Ts (for Mission contracting) and provide liaison support for a series of workshops--e.g. on Nitrogen Fixing Trees, Rapid Appraisal, and Process Documentation to take place between November, 1987 and April, 1988.

- o Manage the first procurement of scientific equipment and vehicles.

- o Prepare the PIO/T and participate in planning and initiating baseline and followup Homestead Production Surveys.

- o Encourage scientists to apply for grants from the \$6.0 million program of the Office of the AID Science Advisor.

Full Implementation Phase (September, 1987-December, 1992)

During this phase the Project Officer will be in contact with the TA Team Leader at least two-three times weekly, for discussion and solution of implementation problems. Furthermore, he or she will:

- o Establish monthly contacts with all other TA advisors.

- o Observe/monitor a cross section of research, training, and extension activities around the country.

- o Visit (after Homestead Agroforestry Teams are established) at least one FSS every month, and all of them each year.

- o Carefully review all reports generated by the Project.

- o Convene the Project Re-Assessment Committee after evaluations are completed, and carry out re-design activities if so charged by the Committee.

Termination Phase (January, 1993-June, 1994)

The Project Officer will:

- o Prepare a memorandum describing Lessons Learned for distribution to Asian Missions and AID/W.

- o Participate in drafting a PID and PP if a successor Project is required.

- o Prepare documents necessary for formal Project closeout.

## SUMMARIES OF PROJECT ANALYSES

### Technical Analysis

#### The Issue

There is ample evidence that supplies of fuel, fodder and construction/craft materials are in short supply over large areas of Bangladesh. (See appendices F, G, and H). Prices have increased substantially over the past several years, and women and children spend large amounts of time collecting twigs, sweeping leaves, even gathering water hyacinths! Informants in many areas agree that distance travelled, time required, and levels of interpersonal competition for fuel and fodder resources on public land have increased substantially.

The existence of a major problem is clear to outside observers and also, apparently, to rural families. The recent FAO survey of homestead forest resources shows that over the past two-three years, there has been an apparent reversal of earlier trends. While fruit trees have been cut heavily, substantial numbers of seedlings (often five-six for each tree cut) are being planted in their place. Rural families are responding to rising prices and short supplies. This augurs well for the project; a strong positive response to new homestead agroforestry practices can be expected.

Homestead agroforestry is not new in Bangladesh. The FAO survey identified 90 distinct tree species on rural homesteads and most families cultivate their homesteads with considerable care. In special cases, there is tree production beyond the homestead. In Northwest Bengal (e.g. Bogra, Rajshahi, Rangpur) farmers cultivate babla (Acacia nilotica) trees in paddy fields. Babla is a light-canopy, nitrogen-fixing tree which can survive for months with its roots under water. It is a good source of fuelwood and timber for furniture construction and cart wheels. Many farmers allow self-seeded babla to remain in their paddy fields. Leaves drop and add nitrogen to the soil; the light canopy causes little damage to adjacent crops; branches are lopped occasionally; and after two-three years, standing trees are sold to fellow villagers for firewood and timber.

Recent price rises and shortages have highlighted the problems of an already productive system. The bad news is that, in the face of rising population and ever more intensive cultivation of field crops, rural families must continue to increase homestead productivity. The good news is that they are willing to do so, and that there already exists a research extension system which can (with external assistance and moderate re-orientation) assist rural families toward substantial productivity gains. One agroforester has concluded that there exists considerable potential on these sites for increased production through the use of improved varieties and introduced species, better management techniques, and increases in the number of trees planted. (Appendix E).

## Modifying the Existing Research System -

At present, are there no units focussed exclusively on agroforestry within the Bangladeshi agricultural research system. Nor is there much research on agroforestry per se. However, with minor organizational changes, different research emphases, and training and re-orientation of scientists, the MAF can become a regional leader in agroforestry research.

The Forest Management Research Branch at FRI currently has six Divisions with research agendas particularly relevant to agroforestry: Silviculture, Minor Forest Products, Forest Economics, Genetics, Soil Science, and Seed Orchards. Each is doing research relevant to one or more "component technologies" in agroforestry. A component technology is one which relates to a specific portion of a farming system:

An example from homestead agroforestry might be the identification, screening and development of suitable or improved varieties of a light shaded multipurpose tree such as Sesbania grandiflora for use as a food, fodder, and fuel source (Appendix E).

These six divisions are authorized for 54 research positions. Of these, perhaps 12-14% (seven or eight) are unfilled due to normal turnover of junior officers. Positions most frequently unfilled are Senior Research Officer (SRO) and Junior Research Officer (JRO) positions. The result is that much of the burden for research falls on Divisional Officers.

The Project will require establishment of a new Agroforestry Research Cell, to operate on a par with other units in the FMRB, to carry out new research in agroforestry, and to coordinate agroforestry work in other divisions. This unit will work closely with HATs at the FSSs. Six-seven professionals and eight-10 support staff will be required; some employees will be newly hired while others will be reassigned from existing divisions. It is estimated that it will take 16-24 months from signing of the Project Agreement to administrative establishment and full staffing of the new Cell. An interim administrative arrangement is required for 12-16 months before the Agroforestry Research Advisor arrives, and for several months after. FRI will be required to prepare a plan for establishment of the Cell, and for interim arrangements leading to full establishment. (The plan will be the subject of a Condition Precedent).

During the interim period, the Agroforestry Research Advisor will be counterparted to the Director of FRI or the Chief of the Forest Management Research Branch. Professional employees already involved in agroforestry research will be constituted as a Steering Committee for agroforestry research. They will form a cadre of individuals to whom training and research resources can be directed, and will work with the Director and Agroforestry Research Advisor in planning and implementation of a core research program in agroforestry. Some members of the Steering Committee will be transferred to the new Research Cell, while others continue to do agroforestry related research in existing divisions. After the new Research Cell is established, the Agroforestry Research Officer will be counterparted

to its Divisional Officer.

The Agroforestry Economics advisor will work closely with two or three professionals in the Forest Economics Division. The latter unit will add two new agroforestry economists.

The work of the Agroforestry Division will begin with compilation of data and reports from all agroforestry-related research projects carried out at FRI over the past 15 years. Work of particular relevance includes:

- o Silviculture: Studies on the growth and yield of bamboo. Growth trials with Leucaena, Eucalyptus, Acacia, Casuarina, and other fast-growing exotics.

- o Seed Orchards: Establishment of clonal seed orchards. Studies of vegetative propagation. Selection and multiplication of fast growing seedlings. Tissue culture techniques for forest trees. Vegetative propagation of bamboos.

- o Soil Science: Studies of the effect of various trees species on soil development and protection. Studies of the nutrient requirements of various species in the seedling stage. Studies of foliar composition and organic matter accumulation of various species.

- o Minor Forest Products: Collection and propagation of medicinal plants, forest products, and canes.

- o Forest Economics: Economic analysis of agroforestry activities. (For greater detail see Appendix E).

Many studies will be immediately useful in supporting, or ruling out, inclusion of particular components in Homestead Agroforestry trials. Some will require updating, while others will lead directly to new lines of component technology research. Much of the new research will be done by Agroforestry Research Cell scientists (in FRI laboratories, Seed Orchards, and SRSs). But other useful work will be done in existing divisions, with the Agroforestry Research Cell taking responsibility for liaison and data exchange. Suggested research topics for scientists at FRI over the next three-four years include:

- o Propagation of fast-growing tree species and bamboos.
- o Pollarding, lopping, pruning and coppicing of important agroforestry tree species.
- o Mixed plantings of nitrogen-fixing tree species and non-nitrogen fixing species, including shrubs and annual crops.
- o Cultural practice improvement.
- o Soil nutrient and water uptake studies.

- o Continued testing and improvement of the ground cover legumes Stylothanses and Dolichos, Guinea and Napier grass.
- o Species trials which include commonly used homestead tree species such as Bombas ceiba, Erythrina indica, Samanea saman, Albizia procera and others.
- o Advanced studies of mass propagation of bamboos.
- o Selection and breeding of promising agroforestry species such as Sesbania grandiflora, S. sesban, and Acacia nilotica.
- o Seed production, collection, storage and dissemination.

Building a sustained capacity for agroforestry research at FRI is fundamental to Project success. However, research is likely to have little impact on homestead practice if it is not tested against the needs, wishes, and limitations of rural families within the varied local ecosystems of Bangladesh. Over the past 10 years, a mechanism has been developed (in Bangladesh and elsewhere) which provides the sort of "reality test" required. Farming Systems Sites (originally Cropping System Sites) have been established at 16 locations, and will soon be expanded to 22. Until now, they have emphasized annual field crop production and largely ignored livestock, fisheries, and homestead production. This Project will expand coverage of homestead production, while projects planned by other donors will introduce livestock and fisheries components.

The following are examples of research which can be usefully conducted at FSSs for purposes and testing technologies for farmer adoption and providing feedback to farmers at research institutes.

- o Identification and classification of existing planting patterns on homestead sites.
- o Characterization of existing agroforestry practices on crop lands and field margins.
- o Design and introduction of improved planting schemes.
- o Testing of the effects of simple management practices such as pruning on wood, fruit, and fodder yields of various tree species.
- o Testing of component technologies such as improved varieties of mango and jackfruit.
- o Species and provenance testing of short-rotation fast-growing trees.
- o Yield and management trials of ground cover crops such as napier grass, Dolichos spp. etc.

The major advantage of homestead (and field) trials at the FSS is that they will be matched against specific, local conditions—markets for fruits, vegetables, bamboo, craft/construction materials; water supply and flooding problems; availability of seedlings and inputs; soil characteristics of anthropic house mounds—and changes—cyclical, random, or secular—over time. Scientists are forced to adopt research agendas which more closely match the requirement of rural producers. Researchers will also directly encounter and, with effort, perhaps find solutions for such social problems as: disputed or ambiguous control over land, arrangements for resource sharings etc. Scientists will be able to identify and recommend some innovations with wide (national or regional) application, and in other cases identify and solve highly localized problems.

### Contract Research

In addition to "core research" at FRI and ongoing trials at FSSs, individual scientists will also identify promising new research topics. Regardless of their location—FRI, BARI, BAU, etc.—they will be able to apply to BARC for grants. BARC will publicize semiannual grant competitions with requests for proposals in specific research lines. In addition, scientists will be encouraged to submit unsolicited proposals in which they include a project justification spelling out the relevance of proposed work to Homestead Agroforestry.

### Social Analysis

#### Homestead Production, the Present System

Homesteads in rural Bangladesh generally have the following common features: 1) They are located on mounds which have been raised above the flood plains by human effort, typically by carrying soil from another location; 2) There is a central drying area of cleared, packed earth where grain, crop residues, dung, fuel wood, etc. are exposed to the sun; 3) Trees, shrubs, bamboo clumps, and other plants cover most of the remaining ground; and 4) One or more houses. Other common features include tanks, areas for tethering livestock, and outbuildings. Homestead size varies widely, from a few decimals to several acres.

Homestead production is critically important in Bangladesh. Impressions from field visits suggest that the proportion of total annual income generated within the homestead may be as high as 10 to 40 percent among rural families. Homestead activities vary widely, of course, with land area, location, and alternate economic resources available to the family. No household typology can adequately represent all this variation. However, a typology can stretch our perceptions beyond simple assumptions "typical rural households" increasing the subtlety of future observations on rural economic life. Rapid rural appraisal has produced a five part typology which provides substantial insight into the types of socio-ecological knowledge that HATs will use as they design trials and select cooperating families at

**FSSs:**

Each homestead type has a different configuration of land resources, income generating activities, household pressures on the homestead, and attitudes toward more intensive homestead use. (Appendix F).

1. Absentee landlords - In many villages there are spacious homesteads belonging to elite families which moved to Dhaka or another city a generation or two back. The caretakers are distant, ineffective kinsmen or former retainers and are not always aggressive in cultivating homestead land or preventing encroachment. These de facto "common lands" are widely, but inefficiently used. Squatters are unsure of their tenure and so do not plant high value trees. (Careful cultivation might motivate owners to reclaim the land). A complex, local version of the problem of the commons arises.

2. Urban-oriented rural residents - Some village residents have outside income, substantial homesteads, and little interest in subsistence crop production. They work in business or salaried jobs, and have good contacts in nearby market towns. (The families of contract workers in the Middle East frequently fit this category.) These individuals are often highly receptive to opportunities in small-scale, high value commercial gardening. Often the homestead is large enough to support such activities. Traditionally popular plantings include: coconut, areca nut, betel leaf, and banana production. Possible innovations include production of winter vegetables, exotic tree seedlings, high quality fodder, and fast-growing fuelwood.

3. Surplus farmers - These families work three or more acres of crop land, and hold homesteads of moderate size. The cooperating farmers at FSSs are typically drawn from this group. They not only produce annual surpluses of grain, but also of fuel and fodder. They emphasize homestead fruit production, but in some cases are willing to experiment with fast-growing multipurpose or timber trees. They sometimes sell whole trees or firewood to neighbors. In flood years they are able to sell rice straw for fodder.

4. Small farmers - These families own less than three acres of crop land, or work as sharecroppers. As a result of generation - by - generation division, they control very small homesteads. They produce grain, fuel, and fodder sufficient for only part of the year, and a bad situation gets worse in flood years. Often, they must sell their cattle at a loss after one cropping season, and buy again at a premium before the next. Women and children spend a lot of their time collecting twigs, branches, leaves and grass from "public" areas. Homesteads are small, but men express an interest in planting more fruit trees. If asked, women and children might support planting strategies aimed specifically at fuel and fodder production, since increased cropping intensity and more people insure that gathered fuel and fodder will become increasingly scarce.

5. Marginal or landless villagers - These families have little or no agricultural land and homesteads are "subdivided to the limit". They have no hope of self sufficiency in grain, fodder, or fuel. Seasonal buying and selling of draft animals is routine. Men work as day laborers, and may receive bamboo shavings or other fuel and fodder as part of daily wages. Women and children make daily gathering forays in "public" areas--village tanks and canals, roadsides and paths, mosque walls, school yards, cemeteries, absentee landlords' homesteads, and fallow fields. Increasingly, there is direct competition, sometimes open confrontation, over twigs and grass. Many families now cook only once or twice a day, in order to conserve fuel.

The typology establishes an important point. Even the most promising Homestead Agroforestry innovations will not meet uniform enthusiasm. Problems of scale, timing, input costs, and risk will make them unattractive to some families. HAT staff must not only consider details of soil type, water supply, and climatic regimes, but must judiciously seek out appropriate socioeconomic settings. Rich and poor, farmers and salaried workers, even males and females within the same family, will prefer subtly different strategies. AFSOs and Field Assistants must "learn how to talk to farmers". In addition to learning about trees and Farming Systems Research, they must learn basic skills in social analysis, rapid rural appraisal, and semi-structured interviewing.

Trials should be designed and cooperating families selected, with type-differences clearly in mind. Under appropriate technologies and legal arrangements, absentee families may be willing to lease homestead land for intensive food/fuel/fodder production. Urban-oriented families may need to hire the landless as seasonal garden workers.

#### Gender Responsibilities in Homestead Management

Men bring crop residues from the fields for use as fuel and fodder. They also cut down large branches and whole trees and cut grass and green water hyacinths for fodder. Women and children, especially in poor families, also cut grass for fodder and gather dried leaves, twigs, tree bark, cowdung, and dried water hyacinths for fuel. Women are responsible for processing crop residues, gathered items, and fuelwood (by sun-drying, sorting, etc) and using them in cooking or feeding animals.

Adults of either sex may be interested in planting, cultivating, and harvesting homestead trees. However, the male household head usually exerts greater control over species selection and seedling quality because he is free to travel to markets and nurseries where they are sold. Women generally plant and harvest trees close to the house, while men are responsible for those farther away. Males generally decide when and how (by family labor, hired workers, or independent bidders) large trees will be cut. In the large number of families headed temporarily (e.g. due to husbands working away at construction sites or in the Middle East) by women, female control over planting and harvesting is substantially greater. At FSSs where the number of female-headed families is high, it may be appropriate to design trials of particular relevance to them. Since management of the

homestead is shared within the family, and women are sometimes prominently involved, it will be necessary to take direct action to reach female family members. For this reason, at least one of the AFAs hired at each site will be female.

### Industries and Crafts

Other special demands for products of homestead production are made by local industries and crafts. Some of these are widespread--e.g. village potteries, parboiling of rice--and others are found at scattered or single locations--e.g. manufacture of special mattresses or mats. A particularly lively local demand--for fuel to fire kilns, a particular type of bamboo or cane for mat construction, coconut leaf spines for broom manufacture--may strongly influence design of homestead trials at some of the FSSs.

### Work Routines and Training of HAT Personnel

Each HAT will be staffed by one AFSO and two-four AFAs. Each HAT will require four AFAs after the first year or two, as homestead trials are expanded to Multi-Location Testing Sites at some distance from the FSS office. At least one of the Field Assistants will be female.

Major tasks of the HAT will include:

- o Local site orientation and analysis.
- o Identification of research priorities and cooperating families.
- o Design and implementation of research trials.
- o Monitoring of trials and data analysis.
- o Production of planting materials.
- o Maintenance of linkages to the agroforestry research and extension system (For details, see Appendix F).

Although inexperienced, HAT staff will be expected to work creatively, on unfamiliar tasks, from the beginning. In addition to instruction received in six months' training for AFSOs and six weeks' training for AFAs, the staff will require frequent outside advice, on-the-job training, and supervision during the first years in the field. To this end, a small Field Coordination Staff will be set up at FRI. One professional (ultimately four) will travel frequently to FSSs, and give HAT staff the technical, administrative, and personal support they will require. Furthermore, they will provide liaison among BARC, FRI, DAE, FD and FSS employees. They will be assisted initially by the Agroforestry Research Advisor. They will participate in the Six Month Agroforestry Course as instructors or trainees.

The Six Month Course for AFSOs will place strong emphasis on field experience. No more than half the coursework will be offered in the classroom. Trainees will spend much of their time visiting field sites and villages, and solving "field problems". Major course units will include: Farming Systems Methodology; Agroforestry Concepts; Important Tree, Bamboo, and Shrub Species; Basic Forestry Skills (Nursery Management, Grafting and Budding, Mensuration); Agricultural Extension Techniques; and Social Analysis/Rapid Rural Appraisal. At

the end of the SMAC, Field Assistants will be brought together for a Six Week Course in which newly-trained AFSOs will have major teaching responsibilities.

### Social Soundness

A few NGOs and government agencies are already working in agro-forestry. The project will play a synergistic role by strengthening laboratory and station research in this field, by bringing research "closer to the farmer" at FSSs, and by establishing a framework in which many individuals and groups can exchange information and cooperate.

Tentative efforts have already been made to identify target groups that will respond favorably to homestead trials of a particular type. With imagination and hard work it may be possible to define technologies and homestead trials in which groups at the socio-economic extremes (e.g. absentee landlords and landless laborers) have complementary interests. Those which provide absentee landlords with higher income from under-utilized homestead land while poor families enjoy higher income and enhanced autonomy working as renting or sharecropping producers of food, fuel, fodder, etc. will be particularly attractive.

"Spread effects" will be actively aided during project implementation. Specifically: Promising homestead trials at the FSSs will be spread in the second or third year to additional trial at Multi-Location Test Sites a few miles away. DAE officials, NGO employees, and private sector dealers in nursery stock, inputs, etc. will all be trained in promising homestead forestry practices. Project funds will sponsor a large number of field days and visits at research stations and FSSs.

Successful trial of micro-strategies at farming system sites will require timely reaction to the following issues:

1) Risk Control: Bangladeshi farmers are generally responsive to price changes but are willing to take only limited risks. Thus the first micro-strategies tested at farming systems sites must limit risks to cooperating households in two ways: First, they must incorporate species and provenances that have minimal chance of failure; Second, they must produce something of value to the household (fodder, fuel, food) within 6-12 months of initiation of the homestead trial. This will encourage the poorest landholding families to cooperate in research/extension activities and firmly establish the legitimacy of Homestead Agroforestry activities at the FSSs.

2) Sharing of Benefits In some cases, control over land on which trials take place will be shared, disputed, or ill-defined. AFSOs will have to cooperate with local residents in developing workable systems for sharing responsibilities and produce. These solutions needn't be uniform from place to place or situation to situation, but should meet local standards of fairness.

## Institutional Analysis

A number of government and private agencies have promoted homestead planting over the past decade. However, in most cases impacts have been limited and there is little evidence that forward momentum will be sustained: few planted trees have been of improved varieties; little research has been done to identify new varieties, better species, or improved management practices; where research has been done, mechanisms for introducing new knowledge into the extension system are lacking and research priorities are little affected by feedback from farmers or extension workers; seedlings are sporadically given away, thus undercutting possible production and marketing initiatives in the private sector; (if any innovation "catches on" we can anticipate enormous problems in matching material supplies to demand).

## Institutional Development

Project success will be closely tied to success in institutional development. Homestead Agroforestry production will increase largely through re-orientation and strengthening of key MAF research, extension, and training organizations. Laboratories must be equipped, new administrative units must be established, and improved processes and procedures must be introduced. It is tempting to focus on the more predictable, pliable aspects of institution building—laboratory construction, equipment installation, preparation of handbooks and regulations. However, ultimately, people must use the laboratories, man the units, and follow the procedures. They must be motivated and informed. A massive training effort is required. The Project will facilitate training of: scientists, professors, trainers, farmers and their families, NGO employees, nursery operators, seedling dealers, and extension workers at several levels in the DAE and FD hierarchies.

Once trained, individuals involved in the Project must coordinate their activities and keep each other well-informed. The Project will facilitate coordination and information exchange by providing funds for: field days and visits to research stations and FSSs; travel to coordination committee meetings, and annual meetings; and publications of a Bangladesh Agroforestry Association. Those involved in the Project must resist their bureaucratic instincts and allow flexibility, redundancy, and self-coordination in Project administration.

## Issues in Personnel Management

Some new positions (for scientists, field workers, administrators) will be created under the Project. After positions are created, they must be filled. Hiring and retention of quality staff is important for most Projects. For this Project, timely recruitment of highly-motivated, field-oriented AFSUs and Field Assistants is probably the single most important challenge. Thus a brief overview of BDG personnel policy is necessary.

"Pure" government services (DAE and FD) and semi-autonomous bodies (BARC, FRI, other research institutes) follow different procedures in creation of new positions and recruitment. Recruitment of cadred officers (the highest, most prestigious wing of civil administration) for pure government service is handled by the Public Service Commission (PSC). Competitive examinations are held annually (or less often) and those tested must declare their preference for a particular cadred service in advance. It may take a year or more to fill an already-created position in a ministry or department.

Employees of semi-autonomous bodies and non-cadred employees of pure government bodies may be recruited any time a position is vacant, so long as appropriate clearances are obtained. Institutes require permission from the Ministry of Establishment and the PSC. Government organizations require permission from the relevant Ministry and the PSC. After permission is granted, positions must be advertised and applicants screened and interviewed. The process takes three to six months.

Pure government organizations intending to create new positions must seek approval from the relevant ministry, the Ministry of Establishment, and the Ministry of Finance. The process takes a minimum of six months, usually longer. Semi-autonomous institutes can create a new position independently, if there is sufficient budget and recruitment rules are adhered to. Thus, in pure government organizations, the time period between recognition that a new position is required and arrival of an incumbent is likely to be 15-18 months. New positions can be created and filled (assuming adequate budgets) more rapidly in semi-autonomous institutes, but never in less than three months. (Perhaps six-nine months is a safer estimate.) Planning of Project research, training, and extension activities must take these time constraints into account.

Employees of pure government organizations are subject to transfer after three years or less in a particular position. In large organizations such as DAE this may imply apparently random movement from one region to another and from one functional responsibility to another. Special skills and area-specific knowledge are often sacrificed under this system. At the other extreme, in existing research institutes, transfers are less frequent and in their mildest form may involve movement to an adjacent division with overlapping concerns. In any case, the Project must deal with the transfer problem, and must particularly avoid premature transfer of AFSOs away from FSSs. A covenant to this effect will be included in the Project Agreement and efforts will be made to develop positive incentives-- e.g. bonuses or special training for those who serve faithfully for a full three year term. In addition, it will be necessary to train more individuals than are strictly required at FSSs and ATIs, so that replacements can be made when absolutely necessary.

#### Research Funding Procedures

BARC has established procedures for solicitation, review, and selection of research proposals that are generally sound. Agroforestry research can be profitably supported by providing

earmarked funds for distribution under the existing system. However, no administrative system is perfect, and a few modifications should be considered. Specifically:

o Time delays - Often, proposals are held for six months or more at BARC before approval. In the future, this time should be reduced to three-five months except for the largest, most complex proposals. (Specific time saving procedures, such as giving reviewers clear deadlines beyond which their comments will not be considered, must be introduced).

o Fund release - Research funds are released on a quarterly basis, after satisfactory accounting of expenditures in the previous quarter. This approach is perhaps an administrative necessity in dealing with inexperienced grantees. However, grantees who have satisfactorily demonstrated their skills in grant administration (e.g. for two or three quarters) should be "graduated" to semi-annual or annual fund releases.

o Thesis research - M.Sc. and Ph.D students at Bangladeshi universities can do useful thesis research in agroforestry. Usually, very small grants will be required. BARC should consider earmarking a small annual fund for thesis and dissertation projects in Agroforestry. Applications could be made at any time, would be approved or rejected within 60 days, and would be limited to one lakh taka (\$3,300).

### Training Issues

In addition to the Six Month Agroforestry Course (for AFPOs ATI instructors and Forest Department SMSs), the Project will support education and training at four levels. First, there will be U.S. and third country degree training, "research associateships", and workshop/seminar series for scientists and educators. Second, there will be "training of trainers", including SMOs, SMSs, UKOs, and others responsible for training a variety of field workers. Third, there will be training for block supervisors, NGO workers, BRDB organizers, nursery operators, and village leaders. Fourth, rural families will be trained in specific methods of Homestead Agroforestry planting, cultivation, and harvest. In general, trainees will learn from instructors at the level immediately above.

These training activities correspond rather neatly to the organogram and training system of the DAE, i.e. ATI instructor--> SMO/SMS/UKO --> Block Supervisor --> Cooperating kural Families. However, when we consider problems of broader integration--How will research results be communicated to field workers? How can DAE, BRDB, and the NGOs cooperate in a particular area?--numerous complexities arise. The people who organize training (TA advisors and DAE officials) will require flexibility and time to search out the best available options in timing, sequencing, location, and content of training at the various levels.

## Dissemination-Extension Linkages

The extension role of the DAE in the Project has been discussed on pages 15-16 and 35. It is appropriate to consider here the role of NGOs, and of public and private sector nurseries, as disseminators of information and plant materials.

Roughly 200 foreign and indigenous PVOs operate programs which involve direct contact with rural families. A few of these organizations run national programs, but most operate in a much smaller area (e.g. a single Union or a few Upazilas). NGO workers are generally dedicated, and well-known in rural areas. Some NGOs are already involved in substantial agroforestry activities and others will take a stronger interest if seedling stock, training, and up-to-date scientific information can be provided. Two obvious ways in which NGOs can be brought into the Project are: inclusion of NGO employees in formal training courses, and exchange of information and planting materials among BDG (mostly DAE, but also FD and BRDB) and NGO employees at the local level. Training courses should prepare DAE, FD, and NGO employees for this kind of cooperation.

Timely production and sale of quality seedling stock through government and private sector and NGO nurseries is essential to Project success. There are three distinct systems of government nurseries which sell tree, fruit and vegetable seedlings to the public. They are: the FD's Community Growth Centers (under the ADB Community Forestry Project) and "ordinary" nurseries (outside the Project area); the DAE's Horticulture Base Nurseries (formerly under the Horticulture Board); and BADC's nursery system. According to the Field Survey of Homestead Agroforestry Practices (see Annex G) 60 percent of respondents are familiar with the location and inventory of nearby government nurseries. Many survey respondents have bought seedlings directly or indirectly (through middlemen) from these nurseries.

In addition, there are private nurseries producing high value (mango, jackfruit, coconut, areca nut, etc) seedlings in Barisal, Rajshahi and other areas of the country\*. Several steps can be taken to make these nurseries more effective disseminators of agroforestry information and materials:

- o Current operations of nurseries, and their associated dealers and middlemen, must be studied and described more carefully so that possible interventions can be identified.

- o Nursery operators must be included in training programs, so that they can dispense planting recommendations and cultivation hints along with seedlings.

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\* Approximately 100 seedling dealers in Swarupkati Upazila already produce and market 10-12 tree species, including at least two fast growing, multi-purpose species.

o Technicians must be trained in grafting, budding, and advanced nursery management techniques.

o Superior genetic material must be released to government and commercial nurseries in a timely fashion.

This area of project implementation is so important that a Seedling Dissemination Advisor will devote full time to problems of seedling multiplication, distribution, and marketing.

For many species to be included in trials and eventually adopted, maintenance of pure seed lines or use of grafted stock is essential for achieving dramatic yield increases. Eventually, the BDG must implement a system for distribution of "certified" or "source-identified" seeds and seedlings.

### Financial and Economic Analysis

#### ExPost Evaluation of Agroforestry Research/Extension Projects

The objectives of this Project revolve around institution building, strengthening human capacity, and increasing research in agroforestry. Few discrete, "saleable" products will be produced until late in the Project. This does not imply that quantifiable benefits will not accrue from project activities. On the contrary, experience and ex post analyses of similar projects in institution building for agricultural research consistently indicate that high economic rates of return can be expected.

Ex ante economic analyses of institution building/research Projects for the purpose of justifying Project approval are seldom done, and will not be done for this Project. Careful analysis is generally reserved for ex post studies several years after projects are completed. Such a study is contemplated for this Project. See Annex K, Issues in Project Implementation, Agroforestry Economists tasks. Ex ante analysis is possible, but dependent on innumerable assumptions and mostly of academic interest. There is a substantial body of evidence from detailed ex post analyses that institution building in agricultural research generally yields strong positive returns. Numerous studies analyzing economic returns to agricultural research and extension were reviewed by Ruttan in 1982.\* Typical economic rates of return noted in these studies range from 20% to over 100%.

Early ex post studies of agricultural research were criticized for their tendency to exaggerate returns. They tended to ignore a portion of costs of complementary technical inputs and those associated with marketing and extension education. In addition, many

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\* Ruttan, Vernon; Agricultural Research Policy; University of Minnesota Press, Minneapolis, 1982.

studies assumed a stronger supply response than experience has shown to be the case. Recent studies have been more cautious. They have paid closer attention to complementary costs and made conservative assumptions regarding benefits. Ruttan's evaluation of the significance of these adjustments is interesting.

The effect of more careful model specification, more complete measurement of costs, and greater caution in estimating benefits has led, in my judgement, to results that tend to underestimate rather than overestimate the returns to agricultural research. (p. 253, emphasis added).

Even under more cautious procedures, estimated returns to agricultural research remain high. Pray\* calculates that annual Internal Rates of Return for rice and wheat research in Bangladesh during 1961-77 are on the order of 30-35 percent. Evenson and Flores\*\* estimate annual returns to Asian national rice research programs during 1966-75 at 73-78 percent, and returns to IRRI research during the same period at 74-102 percent. While these analyze returns to research on foodgrains, they provide--in conjunction with Ruttan's work cited above--strong justification for support of agricultural research.

#### Recurrent Costs

A key factor in sustaining Homestead Agroforestry research and extension activities beyond the seven year life of the Project is the level of recurrent costs which must be borne by the BDG. A brief analysis of recurrent costs by component is presented in Table 5. Recurrent costs to the BDG of continuing the full array of Project activities are estimated at about \$500,000/year.

The Project design recognizes that agroforestry research is a long term endeavor, that usable results emerge slowly, and that Bangladesh will require research in this field over generations. This presents a problem to BDG planners who ordinarily work hard simply meeting emergency and short term needs with scarce resources. This Project seeks to avoid unrealistic assumptions regarding the BDG's ability to allot substantial new resources to long term agroforestry research. As the Project progresses, USAID and the BDG will develop plans for long term support of core activities fundamental to sustaining agroforestry research and extension.

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\* C.E. Pray, "The Economics of Agricultural Research in Bangladesh", Bangladesh Journal of Agricultural Economics, 2 (Dec. 1979), pp.1-36.

\*\* R. Evenson and P. Flores, Economics Consequences of New Rice Technology in Asia, Los Banos, IRRI, 1978.

The recurrent cost problem is quite severe in Bangladesh. Bangladesh has a very low International Comparison of Taxation Index. Inadequate local resources often cause delays in Project implementation. A few years ago, having recognized the problem, the BDG designated a set of "core" projects that would be priority recipients of taka funds. While it is not possible at this time to guarantee that the Homestead Agroforestry Research and Extension Project will be designated a core project, the likelihood that it will is still high. The BDG recognize the very important role of agricultural research in the development of Bangladesh. AID's Agricultural Research Project is a core project. Furthermore, AID's PL-480 taka proceeds are programmed to support recurrent costs of research through the Agricultural Research Project. Some funds already are earmarked to support for research activities at FRI. Additional PL-480 funds may be used to support recurrent costs of the Homestead Agroforestry Research and Extension Project. This decision will be taken during negotiations of the new multi-year PL-480 agreement due to take place this fall.

The BDG is committed to raising its overall tax/GDP ratio. It's commitment to supporting agricultural research is great. The commitment of the BDG is indicated by:

- o Paying salaries and administrative costs of civil servants newly hired during the Project. (The Project will pay salaries of AFAs at HATs, who will be hired on time limited contracts. The government will retain at least one quarter of them, and pay their salaries after the Project.)
- o Accepting an increasing share of the cost of FRI "core" research activities, so that in the last year of the Project they are paying 80%
- o Paying all fuel and maintenance costs for vehicles provided under the Project.
- o Providing an increasing share of contract research expenditures, so that in the last year of the Project they are funding 40 percent of the total.

TABLE 5

RECURRENT COSTS TO THE BDG (\$1=Tk. 30)  
(Beginning FY 1992-93; In 1985 US\$)

Division	Activities	No.	Monthly cost	Monthly cost for admin unit
FRI	New & Transferred Professional Staff	8	Tk. 5,000	Tk. 40,000
	New & Transferred Support Staff	8	2,500	20,000
	Overhead for staff (40% of salary)			24,000
	Vehicles—replacement of 3 jeep, 1 van every 5 years @ \$50,000 Total cost	2		25,000
	Vehicle operation—25,000 miles each per year at Tk. 8/mile			66,000
	Long term research (Provenance trials, etc.)	10		150,000
Universities	New & Transferred Professional Staff	2	5,000	10,000
	New & Transferred Support Staff	2	2,500	5,000
	Overhead for staff 40% of salary)			6,000
	Vehicles—4 vans replaced every 5 years @ \$70,000	3		35,000
	Vehicle operation—10,000 miles each per year at Tk. 8/mile.	2		25,000
	Research support for Faculty			5,000
DAE	New & Transferred Professional Staff in Dhaka	4	5,000	20,000
	New & Transferred Support Staff in Dhaka	6	2,500	15,000
	Overhead for Staff (40% of salary)			14,000
	Vehicles - 4 vans, 1 coaster type bus - replaced every 5 years @ \$100,000	5		50,000

Division	Activity	No.	Monthly cost	Monthly cost for admin unit
DAE (cont..)	Operation - 25,000 miles each per year at Tk. 8/mile	5		83,000
	New & Transferred Professional Staff at 11 ATIs	7	5,000	35,000
	New Transferred Support Staff at ATIs	7	2,500	18,000
	Overhead for staff (40% of Salary)			21,000
	Block Supervisor Training at Tk. 150/day for 5 day course	200		15,000
BARC	New & Transferred Professional Staff	1	5,000	10,000
	New & Transferred Support Staff	3	2,500	8,000
	Overhead for Staff (40% of Salary)			7,000
	Contract Research Grants	1		300,000
	Seminars /Workshops	1		15,000
	2 jeeps replaced every 5 yr at \$25,000			12,000
	Operation of jeeps at 8 Tk./mile—25,000 miles/year			33,000
HAT (Management & Financial Responsibility Shared between BARC & FRI)	New & Transferred Professional Staff (AFSOs)	12	3,000	36,000
	New & Transferred Support Staff (Field Asst)	24	2,000	48,000
	12 motorcycles replaced every 5 years @ Tk. 25,000/cycle.	25		5,000
	Operation of motorcycles at Tk. 1/mile—15,000 miles per year	25		15,000
	24 Bicycles—50% replaced after 5 years	100		1,000
	Equipment and commodities for HATs at Tk. 10,000/yr/FSS	12		9,000

Division	Activity	No.	Monthly cost	Monthly cost for admin unit
	Rent for HATs at Tk. 10,000/yr/FSS	12		9,000
			TOTAL (Tk/Mo)	1,190,000
			TOTAL (Tk/Yr)	14,280,000
				-----
				or
				\$476,000
Primary Components		%	Total/Mo/(Tk)	Total/Yr.(\$)
	Staff	28.3	Tk. 337,000	\$134,800
	Vehicles and Vehicle Operation	29.4	350,000	140,000
	Contract Research	25.2	173,000	120,000
	Other Research	14.5	316,000	69,200
	Training, Seminars	2.5	30,000	12,000

## Homestead Tree Planting--An Indicator of Project Impact

Present Bangladeshi per capita fuelwood consumption is about 2.7 cft/year. Under local conditions (humid, subtropical) about 9 cft/year is calculated as the minimum fuelwood ration necessary for cooking, food processing, construction, potteries, brickkilns, etc. Where the supply is smaller, it can be confidently predicted that the "gap" will be filled by other fuels--imported kerosene, LPG, natural gas, crop residues, etc. In Bangladeshi cities, and near the Titas gas Field families cook with gas. However, for most rural areas, the major alternate fuels are crop residues (rice and wheat straw, jute sticks, rice husks, bagasse), dung, and leaves. Over the past two decades, availability of fuelwood has decreased, and the necessity for using crop residues as fuel has increased. Residues so used are not available as fodder or fertilizer.

It is beyond the bounds of reason to assume that Bangladesh can achieve fuelwood production levels sufficient to provide an annual per capita supply of 9 cft within the next generation or two. Nevertheless, it is appropriate to set a positive production goal against which project impacts can be measured. As a first step the target per capita consumption figure selected is 3.43 cft/year, or 27.4 percent above the current estimated level of 2.7 cft/year and equivalent to 0.1 cubic meter, a standard unit of measure for fuelwood. Table 6 presents a schedule for planting of fuelwood trees which would assure this level of consumption for roughly 12-14 percent of the rural population in 2005.

Average growth rates of fast-growing, carefully managed agroforestry tree species range from 150-500 cft/acre/year of fuelwood. In addition, fodder, food, and other items may be harvested from the same tree. Production figures represent "mean annual increment" (MAI). A single tree will, of course, yield most of its product when it is cut down in the final year. Steady, sustained yield can be attained only by planting some trees, and cutting some, each year. For the fast growing species currently used in tropical fuelwood production a 10 year rotation is appropriate. Typical plantation spacing results in 1200-2000 trees per hectare. At 1600 trees per hectare, equal spacing would place tree at 2.1 meter or 8 foot intervals. Using a mid-range value of 25 cubic meters/hectare/year at 1600/trees/hectare 340 cft/acre/year at 648 trees/acre individual trees would yield an average 0.156 cubic meter (5.35 cft) of fuelwood when harvested at 10 years.

To achieve the per capita target of 3.43 cft/year of fuelwood, on a sustained basis, 0.64 fast growing trees should be planted each year and grow to maturity for each person, and 6.4 should be growing\*. It is useful, now, to shift attention from the individual to the para a

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\* More trees actually should be planted to compensate for those that will not reach maturity.

rural social/residential unit consisting of several families on their separate but adjoining homesteads. If we assume that the para has: five families, 40 people, and standing trees, it would require the planting of 25.6 new trees each year to achieve a sustained per capita fuelwood supply of 0.1 cubic meter (3.43 cft). The marginal requirement to raise per capita consumption by 27 percent (from the present level of 2.7 to 3.43 cft) would be 0.136 trees planted for each person each year or 5.45 trees for a typical para (neighborhood), or roughly one tree per bari (single homestead). A powerful extension campaign which stresses planting of leucaena, eucalyptus, acacia, etc. for sustained fuel production could be built around the slogan "Plant one exotic tree in every bari each year." The analysis in Table 6 page, 60 is based on the assumption that 5.5 additional trees will be planted on each para each year.

A major Project goal is to develop rural awareness and an extension methodology which assures that 14,400,000 rural residents (living in 360,000 paras) will achieve an annual per capita fuelwood supply of at least 0.1 cubic meter within 20 years of project approval. (No effort is made here to assign a value to tree planting as a "benefit stream", since planting rates projected here are hypothetical. However, for those who are interested in ex ante projection of benefit streams, the following approach is possible:

o In the absence of satisfactory data on value fuelwood prices, reasonable estimates may be made by equating calories in fuelwood to calories in alternative fuels (i.e. gas, kerosene, crop residues) and then using the current prices of these fuels as proxies for fuelwood price.

o In the absence of satisfactory data on fodder prices, a reasonable estimate can be made by equating nutrients (calories, protein) in commercial feed to nutrients in fodder and then using the current prices of that commercial feed as a proxy for fodder price.

TABLE 6

**PLANTING TARGET FOR FUELWOOD TREES TO RAISE  
PER CAPITA FUELWOOD CONSUMPTION OF RURAL RESIDENTS**

Year	No. of Trained Ext. Workers	No. of New paras influenced	No. of Paras Planting Trees (Cumulative)	New Trees Planted	Total Trees Growing	Trees Harvested
1987						
1988						
1989	1500	12,000	12,000	66,000	66,000	
1990	3000	24,000	36,000	198,000	264,000	
1991	4500	36,000	72,000	396,000	660,000	
1992	6000	48,000	120,000	660,000	1,320,000	
1993	7500	60,000	180,000	990,000	2,310,000	
1994		60,000	240,000	1,320,000	3,630,000	
1995		60,000	300,000	1,650,000	5,280,000	
1996		60,000	360,000	1,980,000	7,260,000	
1997				1,980,000	9,240,000	
1998				1,980,000	11,154,000	66,000
1999				1,980,000	12,936,000	198,000
2000				1,980,000	14,520,000	396,000
2001					15,840,000	660,000
2002					16,830,000	990,000
2003					17,490,000	1,320,000
2004					17,820,000	1,650,000
2005					17,820,000	1,900,000
2006					17,820,000	1,980,000

**Assumptions used in constructing Table 6:**

- o Each para contains 5 families of 8 members each, for a total of 40 residents.
- o Each tree produces 5.35 cft fuelwood when in its 10th year.
- o Each para plants an additional 5.5 fast growing, fuelwood or multipurpose trees each year to achieve an additional per capita supply of 0.73 cft./year.
- o Block Supervisor training in Agroforestry will reach 7500 workers during the Project.
- o After training, each supervisor will influence the residents of 8 new paras each year to adopt a planting program of 5.5 new trees/year.
- o After 1996, no new para will be influenced.

It should be noted that this target treats fuelwood production only. However, agroforestry projects typically set out to optimize production of two, three, or more products in combination. In the course of research at FRI and the FSSs, particular experiments will attempt to optimize multiple uses of a given plant or piece of ground. In addition to fuelwood, products of potential value to rural families include: food (fruits), tree fodder for cattle and smaller livestock; poles and timber for construction of tools, carts, agricultural implements, furniture, houses, etc; leaves and roots for medications; and bamboo and fibers for mats, baskets, nets, rope, construction materials, etc.

Other "products" of agroforestry are not easily measured. These include: soil stabilization on raised house mounds; and soil improvement from nitrogen fixation and leaf drop. The Project will also create a strong market for high quality tree seedlings and enhance opportunities for establishment or expansion of private nurseries.

### Gender Issues

#### Possible Institutional Constraints on Female Participants

There are clearly traditional barriers in Bangladeshi culture against full participation of women in most facets of life. In response to these barriers, in 1980 the government initiated an "affirmative action" program under which women are to be especially recruited. The agencies and their departments are still far from this goal, although in the past year or two important changes have occurred. In the last Class I examination, 40% of those accepted on merit were women. In addition, some women who passed (but not at the top) were accepted under affirmative action guidelines. Women now comprise over 50 percent of public administration undergraduate students and 25-30 percent of masters level students at Dhaka University. A high proportion of these will enter the cadred government services.

Entry of women into the civil service is so new, however, that few women have reached policy making positions. There is only one female Minister, one Joint Secretary, one Deputy Secretary, and one Member of the Planning Commission. It will be another ten years before women reach the upper levels in significant numbers.

Five percent of the students at BAU are now women and some of these will eventually become SMOs or agricultural researchers. In the absence of role models, the first generation of female professional agriculturists can expect considerable problems—high rates of resignation, divorces, etc.

In the agricultural sector some 300 Block Supervisors are now women and more are being recruited. Women are, however, used differently than male Block Supervisors. They are clustered in groups, work primarily near rural towns, and concentrate on working

with homestead production rather than field crops. Custom does not allow them to use bicycles for transport, so they are confined to foot or rickshaw (which is prohibitively expensive in relationship to meager travel allowances.)

### Role of Women in The Project -

Significant innovations under the Project will include: inclusion of women as potential cooperators in Homestead Agroforestry trials; recruitment of female AFAs; and possible assignment of female AFSOs.

Reasons for giving women a Project role include:

1. Homestead Focus of the Project - This area is the traditional primary work space for Muslim women. Male FSS staff in conservative districts (e.g. Noakhali and Chittagong) are unable to enter homestead areas unless invited in to talk to the male household head. In other areas, male FSS staff find access to homesteads and women difficult. When questioned regarding the possibility of introducing female field assistants, FSS staff members reply that it is a good idea because a woman can enter the homestead and talk to women readily, and monitor research trials there more effectively than a man.

2. Women Involved in Homestead Planting - In many households women plant trees and vegetables around the homestead. This is particularly the case when male household members are away cultivating or marketing crops, or working in town. Also, men in poorer households often work away from the village in day labor jobs.

3. Female-Headed Households - There substantial proportion of female-headed households (perhaps as many as 20 percent in some areas) due to divorce, a husband's death, or men working away in the Middle East or large cities. In some village areas of Noakhali, Comilla, and Dhaka districts, there are so many men working away that it has been necessary to organize women's markets.

4. Precedents for Female Extension Workers - There are other Projects that already assign female extension workers to promotion of homestead production activities (e.g., the DAE Female Block Supervisor Program, MCC's Homesite Production Program, and other NGO projects). This Project will be better able to reach women and provide day-to-day support and special training to female cooperators if there are women on the staff.

5. Legitimizing the Role of Women in Homestead Production - It is important that new homestead agroforestry activities be defined as appropriate for female participation. This may lead to private nurseries run by women, women skilled in grafting and budding, etc. Women on the Project staff will be responsible for organizing special training and demonstration days for female villagers and Block Supervisors.

If women are to be successfully integrated into the Project the following issues must be considered:

## Issues to be Solved

1. Female Commitment to Work and the Project - In selecting women recruits it is important to learn how much control they have over their own work lives. Experience with female Block Supervisors and MCC female extension workers indicates that, while many rural women are tightly controlled by their families or husbands, others have considerable autonomy. The objective is to get strong commitment to job and the Project by carefully selecting recruits with greater maturity, autonomy, and supportive husbands and families.

2. Location of Work and Transfers - Female AFSOs will be treated the same as their male counterparts in terms of transfers and promotions, because they will be permanent DAE employees. However, Field Assistants will be hired (initially) under contracts for the Project period only, and need not be transferred from their home area unless they choose to be. This will provide a more acceptable situation for female AFAs.

3. Location of Home and Work - Another issue that has been mentioned by male FSS staff and villagers is the possibility that female staff who work in their home village will too often remain home doing housework, instead of assigned tasks. They mention precedents among government welfare workers. It's unclear whether this is a real problem or not, but indicates the close scrutiny that Bangladeshi working women must expect. If female staff members are properly trained and supervised and know they are being evaluated on their work performance, it should not be a problem under the Project.

4. Marital Status - Some villagers and BDG officials suggest that it might be easier for married women, rather than single women, to work effectively in villages. It's probably a reasonable assumption that effective work in villages depends largely on the confidence and aggressiveness of a particular woman (e.g., expertise, ability to disregard gossip and strong will) and relatively little on her marital status.

5. Sensitivity Training - It is important that the training of AFSOs and Field Assistants under the Project treat the special problems of female staff members openly. On the one hand, women must know they are expected to be as aggressive and effective in their work tasks as men. On the other hand, it is important for a team spirit to be developed during training, so that male team members are aware of the special problems of female members and are supportive of their work. Some of this can be worked out in one or two group discussions during training.

6. Dress and Travel - Some practical problems for female workers in Bangladesh involve dress and modes of travel. Women will probably have to wear saris and will not be able to ride bicycles or drive motorcycles. This means that their travel allowance must include money for rickshaws and baby taxis.

## DATA COLLECTION AND EVALUATION

Project effectiveness will be documented in four ways: 1. a baseline survey and quarterly followup surveys of homestead production practices; 2. periodic process documentation; 3. implementation assessments; and 4. impact evaluations. Processes 1 and 2 will be carried out under the supervision of Bangladeshi scholars. Processes 3 and 4 will require mixed Bangladeshi/Expatriate teams. Information collected will support at least two major "re-assessments" by the Project Committee at specific points 2-3 1/2 years into the implementation phase. A more specific set of project impact goals will be identified 16-18 months into project implementation and incorporated into a Project Impact Assessment Plan.

### Baseline Survey and Quarterly Followups

A baseline survey of homestead production activities will be carried out in villages adjacent to each FSS in the months following establishment of Homestead Agroforestry Teams. Survey work will be done by AFSOs and Field Assistants, with guidance from Bangladeshi social scientists. Initial coverage will be extensive—roughly 100 families/homesteads at each FSS. Random sampling will be used, and primary emphasis will be on: 1. an inventory of trees and plants; 2. a general description of family economic activities which involve homestead production; 3. an estimate of the economic value of annual homestead production; and 4. description of socioeconomic and microenvironmental variation in production patterns. Data will be collected in a 60-90 minute "walk around" survey. Preliminary data analysis will be done by AFSOs and Field Assistants at the FSS; overall analysis will be done by Social Scientists employed directly, or under contract by BARC or FRI.

After the baseline study there will be quarterly followup surveys to measure: innovation, adoption of specific technologies, and socioeconomic impacts of homestead production. Families/homesteads surveyed will represent a stratified cross-section of families covered in the baseline survey.

The same 6-12 households will be interviewed each quarter, and will be given a modest cash reward for consenting to a two-three hour interview four times annually over a period of four-five years. Interviews will be done by agroforestry Field Assistants assigned to the FSS. Interviewers will walk over the homestead with a family member and carefully document: items planted, inputs used, watering, weeding, and pruning practices, materials harvested; and items used or sold over the previous three months. Where innovations in homestead production are observed, interviewers will carefully record: Who? What? Where? Why? How? When? Data will be analyzed by Social Scientists who will circulate quarterly reports to RAUs and interested scientists, officials, and donors.

## Process Documentation

Several elements of Project administration are risky and innovative. These include: introduction of Homestead Agroforestry Units into the FSS; use of female Field Assistants; coordination among scientists, administrators, field workers and rural residents in designing FSS homestead trials; peer review of contract research proposals; training of innumerable public and private sector "experts" in agroforestry concepts and methods; and broad distribution of genetically superior planting materials. These activities will be spread over many locations and occasions, need to be highly efficient, but are likely to be inefficient and poorly performed in initial stages.

Process documentation is a new implementation procedure designed to alleviate some of these problems. Neutral, trained observers are sent to observe (not intervene in) specific meetings, face-to-face interactions, and other "processes". Their primary purpose is to identify group and systemic successes not individual failures: What made this meeting succeed? How can the experience be replicated elsewhere? Which reports really affected decision making and the final outcome? In which tasks have female Field Assistants been most effective? Why was this new planting technique adopted so quickly? The approach is not "touchy-feely", but emphasizes identification of administrative techniques and procedures that work and spreading them to equivalent situations where they are also likely to work.

Process observers' reports will be submitted to the Project team on an ad hoc, frequent basis and widely distributed to interested scientists, officials, and field workers. Process observers will work part-time, as contractors to BARC. Social Scientists (in Public Administration, Political Science, Sociology, or Anthropology) will be drawn from several universities, and will work largely within the adjacent region. Scholars selected must be field-oriented and excited about practical applications of social science. Two or three individuals will be recruited from BAU, Dhaka University, Rajshahi University, and the University of Chittagong. One of these will be designated group leader, will report to the Member-Director of Forestry at BARC, and will work closely with the Chief of Party of the TA team. Process observers will be available for periodic meetings with the AID Project Manager, TA team members, and government officials to discuss Project progress and possible administrative innovations. The observers will also assemble as a group once or twice a year, to discuss improvements in their methodology and emerging issues in project implementation.

## Implementation Assessments

The effectiveness of project implementation must be examined early on. The Project is innovative and complex, and partial failures are to be expected. Assessment teams will be assembled in June-July, 1988 and October-November, 1989 to examine administrative issues and

suggest possible reforms. The team will include the following disciplinary specialties: Agroforestry Research, Training, Extension, and Institutional Analysis. Ideally the team will be composed of: an Agroforestry expert from AID/W or an Asian Mission, an external consultant (perhaps from ICRAF), the USAID Project Officer, an MAF official, and a BDG official from another ministry.

Issues to be examined include: Are covenants being met? Are research and training proceeding. Are MAF institutions cooperating in shared responsibilities? Are research grants being made in a timely fashion? Are research results being disseminated? Is research feeding into training and extension? Does training have an adequate field orientation?

Following receipt of each Implementation Assessment Report, the Mission will convene a "Project Re-Assessment Committee". The meeting will occupy a full day, take place away from USAID, be chaired by the Chief, Food & Agriculture Office, and be attended by the full USAID Project Committee and at least two BDG officials. The Committee will consider the need for major or minor Project re-design and give a specific charge to the Project Officer.

#### Project Impact Assessment Plan

Significant levels of adoption and substantial economic impacts are expected by the end of the Project in September, 1993. Our assumptions will be tested by Impact Evaluation teams in January - February, 1991 and October - November, 1992. The Evaluation focus will be on adoption of new technologies emerging from Project supported research, and assessment of the effectiveness of DAE and NGOs in encouraging increased adoption of established homestead agroforestry technologies. The assumptions in the initial Cost-Benefit Analysis will be re-examined. Four or five "successful" technologies will be identified, and adoption patterns documented. Two or three "failed" technologies will also be documented.

Each team will consist of four consultants and one MAF official. Required disciplinary specialties include: Forest Economics, Agroforestry, Anthropology, Agricultural Marketing, and Institutional Analysis. The Project Re-Assessment Committee will be reconvened for a half day after each of these evaluations is completed, to consider the necessity and feasibility of follow-on USAID Agroforestry Projects.

In addition to Impact Evaluations scheduled for January-February, 1991 and November-December, 1992, a Project Impact Assessment Plan (PIAP) will be developed to track the impact of Project activities on a regular (quarterly or semiannual) basis. The TA team will confer with counterparts and, within three months of their arrival, submit a PIAP for approval by USAID/Dhaka.

The PIAP will focus on the impact of major Project activities—training, research, extension, establishment of new administrative units—on rural families. One numerical target (for fuelwood supplies) has already been set and is discussed in the Economic Analysis. It provides a reasonable indicator of overall project success, but additional indicators will be developed in the PIAP. In the last two-three years of the Project it will be appropriate to devise indicators which measure the spread of specific homestead agroforestry technologies successfully tested at FSSs.

## CONDITIONS AND CONVENANTS

### Conditions Precedent to Disbursement

Except for technical assistance, prior to any disbursement, or to issuance of any commitment documents under the Project Agreement the Grantee shall furnish, in form and substance satisfactory to A.I.D., evidence that the Grantee has administratively established and made adequate arrangement for staffing of two new administrative units within the Ministry of Agriculture and Forests (MAF) to implement the Project:

- (a) a new Agroforestry Research Cell within the Forest Management Research Branch of the Forest Research Institute (FRI), and
- (b) a new Agroforestry Extension Cell within a division of the Department of Agricultural Extension (DAE).

Disbursements of tranches after the initial fiscal year will be made conditional upon satisfactory progress toward the establishment and adequate staffing of these administrative units.

### Covenants

The Grantee shall covenant that:

(1) The FRI and each MAF research organization supported by A.I.D. funds will readily make available in reasonable quantities all genetic material developed under the Project, such as exotic species, superior provenances and improved varieties of multipurpose or fruit trees, for nursery propagation in the public sector by all other MAF units, organizations, and agencies and to the private sector as deemed appropriate by the parties;

(2) The MAF and the Bangladesh Agriculture Research Council (BARC) will release Project funds in a timely manner to the Agroforestry Research Cell, FRI, to the Agroforestry Extension Cell, DAE, and to other agencies or institutions charged with implementation of the Project;

(3) At least 50 persons from MAF, BARC, and FD will be newly recruited or reassigned, nominated, and cleared for attendance at two or more sessions of the Six Month Agroforestry Course. After

satisfactory completion of the Course, trainees will be assigned as Agroforestry Scientific Officers to Homestead Agroforestry Units at the Farming System Sites, as Agroforestry Instructors at the Agricultural Training Institutes, as Agroforestry Subject Matter Specialists assigned to new Districts; or in other capacities as agreed to by USAID and MAF;

(4) Under applicable BDG regulations, MAF and its constituent administrative units will assign and post individuals trained as Agroforestry Scientific Officers in the Six Month Agroforestry Course to appropriate positions at Farming Systems Sites, Agricultural Training Institutions, or elsewhere for periods acceptable to AID (generally at least three years);

(5) The MAF will assign at least one professional employee as a full participating member for each of the four evaluations (two Implementation Assessments and two Impact Evaluations) to be carried out during the course of the Project. MAF and its constituent organizations will fully cooperate with the Assessment and Evaluation Teams by responding to all reasonable requests for information, and by promptly releasing Project funds earmarked for Assessment and Evaluation;

(6) BARC will solicit and evaluate proposals and award Agroforestry Contract Research Grants in two or more annual cycles. All proposals shall be subjected to scientific peer review, and shall be accepted or rejected within 180 days of the applicable proposal submission date; and

(7) During the last four years of the Project, the BDG will provide increasing levels of funding for activities initiated under the Project. Specifically the BDG will:

Provide budgetary support for core research activities in agroforestry (e.g., long term species trials, provenance trials) at the Forest Research Institute as follows: year 4-25 percent, year 5-50 percent, year 6-75 percent, and year 7-80 percent.

Provide budgetary support for contract research activities coordinated by BARC as follows: year 4-10 percent, year 5-20 percent, year 6-30 percent, and year 7-40 percent.

**ACTION:**  
**AID**

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FM SECSTATE WASHDC  
TO AMEMBASSY DHAKA PRIORITY 8267  
BT  
UNCLAS SECTION 01 OF 02 STATE 313943

AIDAC

INFO:	
AMB	1
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E.O. 12356: N/A  
TAGS:  
SUBJECT: ON-FARM FORESTRY DEVELOPMENT PROJECT - APAC  
REVIEW OF PID (339-2062)

1. ASIA PROJECT ADVISORY COMMITTEE (APAC) APPROVED THE PROJECT IDENTIFICATION DOCUMENT (PID) FOR THE SUBJECT PROJECT OCTOBER 11. YOU SHOULD PREPARE PROJECT PAPER (PP) AND APPROVE PROJECT TAKING INTO ACCOUNT APAC DESIGN CONCERNS BELOW.

2. TECHNOLOGY.

A. THE APAC AND MISSION REPRESENTATIVES AGREED THAT THE TECHNICAL CONTENT OF THE THE PROJECT WILL BE ESSENTIAL TO ITS SUCCESS. TECHNOLOGIES THAT ARE GOOD WILL BE PICKED UP, EVEN WITH LESS THAN OPTIMAL DISSEMINATION AGENCY. THE DESIGN TEAM WILL INCLUDE EXPERTS CAPABLE OF NARROWING THE FOCUS OF RESEARCH APPROACHES AND SPECIES SELECTION TO THOSE MOST LIKELY TO PRODUCE THE NEEDED RESULTS: THAT IS, VARIETIES, SEED AND METHODS THAT FARMERS WILL READILY ADOPT BECAUSE THEY CAN MAKE MORE MONEY OR SATISFY OTHER NEEDS. BUREAU STAFF ARE WORKING WITH MISSION STAFF TO PUT TOGETHER A DESIGN TEAM MEETING THESE NEEDS.

B. THE APAC SUPPORTED THE PID APPROACH TO REACH THE 70 PERCENT OF RURAL PEOPLE WITH ACCESS TO HOMESTEAD LAND, BUT ALSO SUGGESTED THAT SOME PROJECT FUNDS BE MADE AVAILABLE FOR EXPERIMENTATION WITH APPROACHES LIKELY TO BENEFIT THE COMPLETELY LANDLESS.

C. THE PROJECT COMMITTEE AND APAC DISCUSSED POSSIBLE DESIGN INPUT SOURCES: INTERNATIONAL AGRICULTURAL RESEARCH CENTERS, CENTRAL AND REGIONAL PROJECTS, AND GRAY AMENDMENT SOURCES. PP DESIGNERS SHOULD ALSO EXAMINE EXPERIENCES OF OTHER AID FARM/FORESTRY PROJECTS, ESPECIALLY THOSE IN INDIA.

D. THE PP SHOULD ALSO ADDRESS MISSION TECHNICAL STAFFING REQUIREMENTS FOR THIS FIRST FORESTRY PROJECT. EXPERIENCE ELSEWHERE HAS BEEN THAT WEAKNESS IN TECHNICAL STAFFING HAS SERIOUSLY REDUCED EFFECTIVENESS OF FORESTRY AND RELATED PROJECTS.

3. INSTITUTIONAL/SOCIAL.

A. THE APAC AGREED THAT THE PID'S INSTITUTIONAL DEVELOPMENT APPROACH -- STRENGTHENING EXISTING SOG AGENCIES -- MAKES GOOD SENSE. THESE INCLUDE THE RESEARCH INSTITUTIONS WHICH HAVE BEEN COOPERATING AGENCIES ON PREVIOUS AID PROJECTS.



- 1. THE APAC ALSO NOTED THAT PRIVATE CHANNELS WOULD ALSO BE USED FOR DISSEMINATION OF TECHNOLOGY DEVELOPED THROUGH THE PROJECT. PP DESIGN SHOULD PURSUE ALL POSSIBILITIES OF PRIVATE COMMERCIAL AND VOLUNTARY ORGANIZATIONS PARTICIPATING IN THE PROJECT. TOBACCO COMPANY ENCOURAGEMENT OF FUEL WOOD PRODUCTION WAS CITED. HOWEVER, THE DEVELOPMENT OF TECHNOLOGY BY PVO'S IS UNLIKELY TO BE AS EFFECTIVE AS BY LARGER GOVERNMENT RESEARCH AGENCIES.

- C. GOOD ANALYSIS OF FARMER DEMAND, INCLUDING FOCUS ON WOMEN, FOR VARIOUS USES OF TREE PRODUCTS IS PARTICULARLY CRITICAL IN SELECTION OF SPECIES FOR DIFFERENT FARMING SYSTEMS.

#### 4. PROJECT LENGTH/EVALUATION.

- A. THE APAC RECOGNIZED THAT THE PID WAS CAUTIOUS ABOUT CLAIMING TOO MUCH FOR THE INITIAL PROJECT IN A LONG-RANGE FORESTRY RESEARCH/INSTITUTIONAL DEVELOPMENT EFFORT. HOWEVER, APAC FELT IT IS POSSIBLE TO SET MORE IMMEDIATE OBJECTIVES. THIS IS NOT THE FIRST ASIAN

FORESTRY RESEARCH PROJECT; SOME RESEARCH AND DISSEMINATION ACTIVITIES ARE ALREADY UNDERWAY IN BANGLADESH. THE PP SHOULD NOT UNDULY LIMIT TECHNICAL ACHIEVEMENT TARGETS.

- B. THE APAC FELT EVALUATIONS SHOULD NOT BE LIMITED IN THE FIRST FEW YEARS TO THE INPUT/OUTPUT LEVEL CONTEMPLATED BY THE MISSION. OUTSIDE TECHNICAL EVALUATION, EVEN IN EARLY YEARS, SHOULD CHECK WHETHER TECHNOLOGIES UNDER DEVELOPMENT REFLECT THE CHANGING EXPERIENCE OF OTHER FARMING/FORESTRY DEVELOPMENT EFFORTS ELSEWHERE. SIMILARLY, THE IMPACT OF EVEN EXPERIMENTAL EFFORTS ON FARMERS IN THE AREAS AROUND RESEARCH STATIONS SHOULD BE CHECKED. THESE EVALUATION APPROACHES MIGHT BE COORDINATED WITH REGIONAL AND CENTRAL PROJECTS SO THAT EACH BENEFITS FROM EXPERIENCES OF THE OTHERS.

#### 5. RECURRENT COSTS.

MISSION REPRESENTATIVES INDICATED THAT ABOUT 50 PERSONS (15 PROFESSIONALS) WOULD BE THE EXTENT OF BDC RECURRENT COSTS OF THE PROJECT. THIS APPEARED TO BE WITHIN REASON, BUT THE PP SHOULD SPELL OUT WHAT RESOURCES WILL BE NEEDED ON A RECURRING BASIS AND HOW THEY WILL BE PROVIDED.

#### 6. IMPLEMENTATION.

- A. IN VIEW OF THE COMPLEXITY OF TECHNICAL SUBJECT MATTER, THE MISSION SHOULD CONSIDER SEEKING THE BROADEST SOURCES OF ADVISORY SERVICES.

- B. PREIMPLEMENTATION ACTIONS ARE SUGGESTED: (I) EARLY ADVERTISING FOR CONTRACTORS AND (II) SENDING COUNTERPARTS FOR TRAINING SO THEY WILL RETURN EARLY IN PROJECT IMPLEMENTATION.

7. THE PP SHOULD INDICATE WHETHER PARTS OF THE PROJECT CAN BE FUNDED FROM OTHER THAN THE SECTION 103 ACCOUNT, E.G. SECTION 105 FOR TRAINING.

SHULTZ

BT

#3943

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project:  
From FY 86 to FY 93  
Total U.S. Funding \$14.8 Million  
Date Prepared: 22 June 1986

Project Title & Number: Homestead Agroforestry Research & Extension (388-0042)

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTION
<p><b>Program or Sector Goal:</b> The broader objective to which this project contributes:</p> <p><u>Program Goal:</u></p> <p>To increase rural incomes through greater production of fuel, fodder, construction and handicraft supplies, and food on privately held homestead land.</p>	<p><b>Measures of Goal Achievement:</b></p> <p><u>Goal:</u></p> <p>By the end of the Project at least 300,000 rural families will be planting fuelwood or multipurpose trees annually on their homesteads.</p>	<p><u>Goal:</u></p> <ol style="list-style-type: none"> <li>1. Base line surveys</li> <li>2. Rapid Appraisal Studies</li> <li>3. Impact Evaluations</li> <li>4. Implementation Assessments</li> <li>5. End of Project Evaluation</li> </ol>	<p><u>Goal:</u></p> <p>Rural families are committed to homestead production.</p>
<p><u>Project Purpose:</u></p> <p>To develop a capability within Bangladesh's Ministry of Agriculture and Forests to provide on a continuing basis, the support and assistance needed by the Nation's rural families to increase production and enhance returns from their cultivation of trees, shrubs, bamboo and ground covers.</p>	<p><u>End of Project Status:</u></p> <ol style="list-style-type: none"> <li>1. Research trials are being carried out on the homesteads of 2,700 cooperating farmers associated with the 22 farming system sites. The research experiments will have been selected based upon analysis of farmers needs and opportunities.</li> <li>2. Farmers adopting planting recommendations will significantly increase their net returns from tree, shrub, bamboo and ground cover cultivation.</li> <li>3. Supplies of appropriately protected and "source identified" seed for all tree, shrub, bamboo, and ground cover species being promoted for HAF use are being produced by HDAF and private sector nurseries and sold to rural families.</li> <li>4. Planting recommendations made by HDAF staff based upon research conducted both at FRI stations and at the FSS's are adopted by significant number of neighbors of cooperating families at FSS's.</li> <li>5. DAE employees will have been trained in agroforestry extension and assigned to work as ATI's.</li> <li>6. FRI Silvicultural Research Stations will be carrying out regional screening trials of different species, sub-species and provenances which show good promise for homestead adoption and use. Stations will provide adequately tested new species sub-species or provenances for testing at FSS's.</li> </ol>	<p><u>PURPOSE:</u></p> <ol style="list-style-type: none"> <li>1. Project records and evaluation.</li> <li>2. Project evaluation.</li> <li>3. HAF records, project records/reports and evaluation.</li> <li>4. Observation, project reports/records and evaluation.</li> <li>5. DAE records.</li> <li>6. FRI research data, reports, records and evaluation.</li> <li>7. Observation, project reports/records Contractors reports/records and surveys.</li> <li>8. Observation, evaluation, project records/reports, surveys.</li> <li>9. University records, project records/reports.</li> <li>10. Project records/reports.</li> </ol>	<p><u>PURPOSE:</u></p> <ol style="list-style-type: none"> <li>1. Research has been tested and farmers are willing to participate.</li> <li>2. Suitable methods can be developed for forecasting the financial attractiveness of new HAF technologies for rural families.</li> <li>3. Nursery networks of FD, DAE and DARC are willing and able to produce seedlings in a timely manner. Private sector nursery men will be able to produce and sell seedlings at a profit.</li> <li>4. Cropping system sites will be successfully upgraded to Farming Systems Sites.</li> <li>5. Suitable training site located and adequate number of personnel assigned by DAE to be trained.</li> <li>6. FSS's are capable of producing significant research results and DAE is able to transfer results to farmers.</li> <li>7. FSS's are producing significant research results on species and techniques.</li> <li>8. FSS's are producing significant research results on species and techniques.</li> <li>9. Students are willing to enroll in new subject field.</li> <li>10. There is adequate and reliable data to generate and publish findings.</li> </ol>

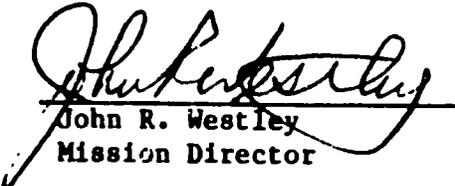
NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS
<p><u>Project Purpose:</u></p>	<p><u>End of Project Status:</u> (continued)</p> <p>7. BAE employees (and other extension workers) will be receiving regular information and training on appropriate new Homestead Agroforestry species and techniques emerging from trials at FBS's.</p> <p>8. BAE employees (and other extension workers) will be disseminating information on appropriate Homestead Agroforestry species and techniques to rural families.</p> <p>9. At least 15-25 individuals/year will be graduating from universities with training in Agroforestry.</p> <p>10. Homestead Agroforestry research and extension results from Bangladesh are being regularly reported to and published in international journals.</p>	<p><u>Purpose:</u></p>	<p><u>Purpose:</u></p>

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTION
<p><u>Outputs:</u></p> <ol style="list-style-type: none"> <li>1. Agroforestry Research Cell established at Forest Research Institute (FRI).</li> <li>2. Agroforestry Extension Cell established at Dept. of Agricultural Extension (DAE).</li> <li>3. Homestead Agroforestry Teams (HAT) established at Farming Systems Sites.</li> <li>4. Contract research funds established to support researchers in adopting new lines of agroforestry related research.</li> <li>5. International and in-country training, workshops, degree programs &amp; research associate-ships provided to scientists, administrators, extension workers &amp; students.</li> <li>6. Agroforestry course designed and introduced into training program for DAE &amp; FSS personnel and university curriculum for undergraduate students.</li> <li>7. Homestead Agroforestry Promotional/ Informational workshops designed and implemented and educational materials produced.</li> </ol>	<p><u>Magnitude of Outputs to achieve purpose:</u></p> <ol style="list-style-type: none"> <li>1. By end of year 1.</li> <li>2. By end of year 1.</li> <li>3. 5-6 HAT's in year 3. 16-17 HAT's by end of year 7.</li> <li>4. 135 Homestead agroforestry research experiments and trials initiated by end of year 7.</li> <li>5. 7,500 Personnel trained in agroforestry research and extension by the end of year 7.</li> <li>6. By end of years 2 and 3.</li> <li>7. 303 by end of year 7.</li> </ol>	<p><u>Outputs:</u></p> <ol style="list-style-type: none"> <li>1. NAF &amp; FRI Records.</li> <li>2. NAF &amp; BAE Records.</li> <li>3. NAF, Project Manager and Contractor records and reports.</li> <li>4. BARC/Contractor/Project Manager records and reports.</li> <li>5. Project records &amp; reports.</li> <li>6. Project records &amp; reports.</li> <li>7. Contractor/Project Manager/DAE/ BARC/FD reports and records.</li> </ol>	<p><u>Outputs:</u></p> <ol style="list-style-type: none"> <li>1. NAF &amp; Planning Commission approve Project Proposal.</li> <li>2. NAF &amp; Planning Commission approve Project Proposal.</li> <li>3. Existing FSS's researchers willing to cooperate with NAF researchers.</li> <li>4. Funds available to carry out research.</li> <li>5. Suitable programs, seminars &amp; workshops exist in the U.S. and Third Countries.</li> <li>6. U.S. Fira/Expatriate is available to design course/curriculum.</li> <li>7. U.S. Fira/Expatriate is available to design workshops and produce materials.</li> </ol>
<p><u>Inputs Activities:</u></p> <p><u>AID Provided</u></p> <ol style="list-style-type: none"> <li>1. Provide pre-implementation conferences, workshops and study tours.</li> <li>2. Provide resident and short term technical assistance.</li> <li>3. Provide training in-country and abroad.</li> <li>4. Provide equipment, commodities and vehicles.</li> <li>5. Provide funds for research and extension support.</li> <li>6. Funds for contingencies/inflation.</li> </ol> <p><u>DBG Provided</u></p> <p>Provide requisite research staff, facilities and local costs.</p>	<p><u>Level of Expenditure:</u></p> <p><u>AID Provided</u></p> <ol style="list-style-type: none"> <li>1. Pre-implementation Activities \$ 300,000</li> <li>2. Technical Assistance \$ 6,600,000</li> <li>3. Training \$ 1,040,000</li> <li>4. Equipment/Commodities/ Vehicles \$ 745,000</li> <li>5. Research/Extension Support \$ 3,000,000</li> <li>6. Contingencies/Inflation \$ 2,815,000</li> </ol> <p style="text-align: right;">Sub-total: \$14,500,000</p> <p><u>DBG Provided</u></p> <p>Staff, facilities and local costs \$ 2,500,000</p> <p style="text-align: right;">Total: \$17,000,000</p>	<p><u>Inputs:</u></p> <ol style="list-style-type: none"> <li>1. Internal reviews.</li> <li>2. External reviews.</li> <li>3. Project disbursement reports.</li> <li>4. Audit reports.</li> <li>5. Project Manager reports and records.</li> <li>6. Contractor reports and records.</li> <li>7. DBG reports and records.</li> </ol>	<p><u>Inputs:</u></p> <ol style="list-style-type: none"> <li>1. Procurement, training and technical services delivered on a timely basis.</li> <li>2. Project work plan implemented on schedule.</li> <li>3. AID and DBG funds available and disbursed.</li> </ol>

INITIAL ENVIRONMENTAL EXAMINATION

Project Location : Bangladesh  
Project Title : Homestead Agroforestry Research and  
Extension Project (388-0062)  
Life of Project : 7 years  
IEE Prepared by : Kevin A. Rushing, Agricultural  
Development Officer  
Date : 30 June 1986  
Recommended Action : Negative Determination  
Concurrence :

I have reviewed the Initial Environmental Examination for the Homestead Agroforestry Research and Extension Project and concur in the Threshold Decision recommendation for a Negative Determination for all Project activities except pesticides use.

  
John R. Westley  
Mission Director

## INITIAL ENVIRONMENTAL EXAMINATION

### 1. Project Description

The purpose of the Project is to enhance the capacity of institutions within the Ministry of Agriculture and Forests to carry out research, extension, training and education to better assist rural families to increase production of trees, shrubs, bamboos and ground covers on their homesteads.

Project funds will be used to provide technical assistance, training and commodities to support designated agroforestry research activities which will strengthen the Bangladesh Agricultural Research Council, the Bangladesh Forestry Research Institute, the Directorate of Agricultural Extension, and agroforestry education institutions.

### 2. Identification and Evaluation of Environmental Impacts

#### A. Land Use

##### 1) Changing the Character of the Land through:

a) Increasing Population: None.

b) Extracting Natural Resources: The field agricultural activities will change the soil fertility. However, these soil nutrients will be replaced periodically with the expectation that the soil quality will actually improve over the course of the life of the Project.

c) Land Clearing: Only a very limited amount of land clearing will take place in this project, most of which will be on experimental fields of the research stations or in the cultivated fields of demonstration farmers. Most of the vegetation will be in the form of weeds or soft brush, which has no special or unique ecological or economic value.

d) Changing the Character of the Soil: No physical changes to the soil are contemplated except the routine removal of debris, minor land levelling in established fields, or ditching for on-farm irrigation. On the contrary, improved agroforestry systems with sustained production will increase soil productivity by using a proportion of leguminous nitrogen-fixing tree species.

##### 2) Altering Natural Defense of the Area

With few exceptions, existing trees on farmers' lands will be only very gradually replaced. Only temporary and minimal soil erosion problems are likely to emerge. Since this is an Agroforestry Research and Extension Project, the management practices applied on

the production sites will follow the basic principles of reducing soil erosion and assuring that land problems principally related to surface water flow will be addressed appropriately.

3) Foreclosing Important Uses

The lands at the research stations and those used for on-farm studies are for the purpose of testing new agroforestry technology which can be ultimately used by the farmers of Bangladesh. These are important uses and well justify the temporary foreclosure of the research land for other purposes.

4) Jeopardizing Man and His Works

Any construction, land development or rehabilitation will be done according to acceptable practices in Bangladesh and on existing forestry research stations.

B. Water Quality

1) Changing the Physical State of the Water

There will be drainage problems during the monsoon season, but this is in the nature of things for Bangladesh. Regular maintenance practices on the experimental fields will be applied to reduce problems of water-logging to enable necessary agroforestry research to take place.

2) Changing the Chemical and Biological State

Chemical fertilizer, herbicides and pesticides to be used in this Project do have a potential for creating adverse effects on the environment. However, all chemicals used for research purposes will be under the close supervision of Project personnel and should not create any adverse effects. All pesticides to be used are already in widespread use in Bangladesh. Only pesticides used in farmer's field trials (by farmers) have a potential for creating adverse environmental impacts, due to farmer's unfamiliarity with these chemicals, and these will be closely monitored.

3) Changing the Ecological Balance of a Water Body

None

C. Atmospheric

No adverse environmental impact.

D. Natural Resources

1) Diversion, Altered Use of Water

Increased water consumption will be within the existing capacity of the research facilities and not require any modification to existing water supply.

2) Irreversible, Inefficient Commitments

No irreversible or inefficient commitments will result from this Project.

E. Cultural

No adverse environmental impact.

F. Socio-Economic

1) Changes in economic/employment patterns. This Project could enhance employment opportunities through the generation of increased agroforestry production, particularly in the rural area.

2) Change in Population

This Project will not play an active role in changing the population of the country.

3) Changes in Cultural Patterns

This Project of itself will have no effect on changes in cultural patterns.

G. Health

1) Changing a Natural Environment

This Project should not affect any natural disease control vectors. It may prompt the increased use of non-chemical means of pest and weed control.

2) Eliminating an Ecosystem Element

No element of any health related ecosystem is involved in the Project.

3) Safety Provisions

All necessary recommended safety precautions will be applied in classroom, laboratory and field education programs.

H. General

1) International Impacts

Project provides technology, training opportunities and commodities from sources outside the region that are socially and economically acceptable and which will contribute to overall well-being of the region's agroforestry programs.

2) Controversial Impacts

This Project is in line with the commitment of the Government of Bangladesh to develop the appropriate capacity and effectiveness of agroforestry research which can be utilized by Bangladesh farmers.

3) Larger Program Impacts

This Project will have a positive impact on future agroforestry development programs of Bangladesh.

3. Recommendation for Environmental Action

On the basis of the information supplied herein, it is indicated that all Project activities, except possibly the use of pesticides, will not have a significant adverse effect on the environment. Further environmental analysis of pesticides use is not required under AID Environmental Regulations when they are to be used in "controlled experimentation exclusively for the purpose of research which is confined to small areas and carefully monitored." However, since the Project may also support the use of pesticides in farmers' fields and the dissemination of information of pesticides use, the Mission recommends that further environmental analysis on pesticides use be conducted for any pesticides to be used in trials in farmers' fields which are not already in widespread approved use in Bangladesh.

PROJECT NO. 388-0062

STATUTORY CHECKLIST

5C(1) - COUNTRY CHECKLIST

See the Country Checklist submitted with the Project Paper for Rural Electrification III Project (No. 388-0070).

5C(2) - PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? a) Yes.  
HAS STANDARD ITEM CHECKLIST BEEN  
REVIEWED FOR THIS PROJECT? b) Yes.

A. GENERAL CRITERIA FOR PROJECT

1. FY 1986 Continuing Resolution Sec. 524, FAA Sec. 634A.

Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project.

Congressional Notification will be made before obligation.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$500,000, will there be (a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

(a) Yes.

(b) Yes.

3. FAA Sec. 611(a)(2). If further legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance?

Not required.

4. FAA Sec. 611(b); FY 1986 Continuing Resolution Sec. 501. If for water or water-related land resource construction, has project met the principles, standards, and procedures established pursuant to the Water Resources Planning Act (42 U.S.C. 1962, et seq.)? (See AID Handbook 3 for new guidelines.)

N/A

5. FAA Sec. 611(e). If project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? N/A
6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs. No.
7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions. (a) N/A  
(b) It will support establishment of private nurseries for multipurpose tree seedlings and similar products.  
(c) N/A  
(d) N/A  
(e) It increases the efficiency of agriculture through introduction of new home-stead agroforestry practices.  
(f) N/A
8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise). N/A
9. FAA Secs. 612(b), 636(h); FY 1986 Continuing Resolution Sec. 507. Describe steps taken to assure that, to the maximum extent possible, the country is contributing local currencies to meet the cost of contractual and other services, and foreign currencies owned by the U.S. are utilized in lieu of dollars. The host country will contribute salaries, facilities, and operating expenses equivalent to \$2.5 million during implementation of the project.
10. FAA Sec. 612(d). Does the U.S. own excess foreign currency of the country and, if so, what arrangements have been made for its release? No.
11. FAA Sec. 601(e). Will the project utilize competitive selection procedures for the awarding of contracts, except where applicable procurement rules allow otherwise? Yes.

12. FY 1986 Continuing Resolution Sec. 522. If assistance is for the production of any commodity for export, is the commodity likely to be in surplus on world markets at the time the resulting productive capacity becomes operative, and is such assistance likely to cause substantial injury to U.S. producers of the same, similar or competing commodity? N/A
13. FAA Sec. 118(c) and (d). Does the project comply with the environmental procedures set forth in AID Regulation 16? Does the project or program take into consideration the problem of the destruction of tropical forests? a) Yes.  
b) Yes. The Project will alleviate pressures on natural forests through increased homestead production of timber, fuelwood, fodder and bamboos.
14. FAA Sec. 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)? N/A
15. FY 1986 Continuing Resolution Sec. 533. Is disbursement of the assistance conditioned solely on the basis of the policies of any multilateral institution? No.
16. ISDCA of 1985 Sec. 310. For development assistance projects, how much of the funds will be available only for activities of economically and socially disadvantaged enterprises, historically black colleges and universities, and private and voluntary organizations which are controlled by individuals who are black Americans, Hispanic Americans, or Native Americans, or who are economically or socially disadvantaged (including women)? 20%

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria:

a. FAA Secs. 102(a), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives,

(a) The rural poor will participate in the project by producing fuel, fodder, and other products in their own homestead land. They will find increased opportunities through working in intensive homestead production (e.g., fuelwood plantation, seedling nurseries on the land of wealthier rural residents, and they will be able to work at a variety of crafts

Eyb

especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?

c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

e. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

f. FAA Sec. 128(b). If the activity attempts to increase the institutional capabilities of private organizations or the government of the country, or if it attempts to stimulate scientific and technological research, has it been designed and will it be monitored to ensure that the ultimate beneficiaries are the poor majority?

g. FAA Sec. 281(b). Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage institutional development; and supports civil education and

due to increased supplies of bamboos, canes, seeds, etc.

(b) N/A

(c) N/A

(d) Women will participate in the Project as homestead cultivators. They will be given particular encouragement through introduction of female field assistants into the research/extension system

(e) N/A

Yes, Sec. 103

Yes.

No, Cooperating Country will provide 17.2%; 25% requirement will be waived as Bangladesh is an RLDC.

Yes.

Yes.

The project will support individuals and families in enhancement of their material welfare (through enhanced Homestead Agroforestry Production.) It will strengthen the capacity of Ministry of Agriculture

training in skills required for effective participation in governmental processes essential to self-government.

culture and Forestry institutions to carry out research and extension in a manner which is both efficient and responsive to the needs of rural families.

2. Development Assistance Project Criteria (Loans Only):

a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest.

N/A

b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan?

N/A

3. Economic Support Fund Project Criteria:

a. FAA Sec. 531(a). Will this assistance promote economic or political stability? To the maximum extent feasible, is this assistance consistent with the policy directions, purposes, and programs of part I of the FAA?

N/A

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities?

N/A

c. ISDCA of 1985 Sec. 207. Will ESF funds be used to finance the construction of, or the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such country is a party to the Treaty on the Non-proliferation of Nuclear Weapons or the Treaty for the prohibition of Nuclear Weapons in Latin America (the "Treaty of Tlatelolco"), cooperates fully with the IAEA, and pursues nonproliferation policies consistent with those of the United States?

No.

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made?

N/A

PROJECT NO. 388-0062

5C(3) - STANDARD ITEM CHECKLIST

Listed below are the statutory items which normally will be covered routinely in those provisions of an assistance agreement dealing with its implementation, or covered in the agreement by imposing limits on certain uses of funds.

These items are arranged under the general headings of (A) Procurement, (B) Construction, and (C) Other Restrictions.

A. PROCUREMENT

1. FAA Sec. 602. Are there arrangements to permit U.S. small business to participate equitably in the furnishing of commodities and services financed? Yes.
2. FAA Sec. 604(a) Will all procurement be from the U.S. except as otherwise determined by the President or under delegation from him? Yes.
3. FAA Sec. 604(d). If the cooperating country discriminates against marine insurance companies authorized to do business in the U.S., will commodities be insured in the United States against marine risk with such a company? Yes.
4. FAA Sec. 604(e); ISDCA OF 1980 Sec. 705(a). If offshore procurement of agricultural commodity or product is to be financed, is there provisions against such procurement when the domestic price of such commodity is less than parity? (Exception where commodity financed could not reasonably be procured in U.S.) N/A
5. FAA Sec. 604(g). Will construction or engineering services be procured from firms of countries which receive direct economic assistance under the FAA and which are otherwise eligible under Code 941, but which have attained a competitive capability in international markets in one of these areas? Do these countries permit United States firms to compete for construction or engineering services financed from assistance programs of these countries? No.
6. FAA Sec. 603. Is the shipping excluded from compliance with requirement in section 901(b) of the Merchant Marine Act of 1936, as amen-

ded, that at least 50 per centum of the gross tonnage of commodities (computed separately for dry bulk carriers, dry cargo liners, and tankers) financed shall be transported on privately owned U.S. flag commercial vessels to the extent such vessels are available at fair and reasonable rates?

No.

7. FAA Sec. 621. If technical assistance is financed, will such assistance be furnished by private enterprise on a contract basis to the fullest extent practicable? If the facilities of other Federal agencies will be utilized, are they particularly suitable, not competitive with private enterprise, and made available without undue interference with domestic programs?

a) Yes.

b) N/A

8. International Air Transport. Fair Competitive Practices Act, 1974. If air transportation of persons or property is financed on grant basis, will U.S. carriers be used to the extent such service is available?

Yes.

9. FY 1986 Continuing Resolution Sec.504. If the U.S. Government is a party to a contract for procurement, does the contract contain a provision authorizing termination of such contract for the convenience of the United States?

Yes, such clauses are routinely inserted in all A.I.D.-direct contracts.

B. CONSTRUCTION

1. FAA Sec. 601(d). If capital (e.g., construction) project, will U.S. engineering and professional services be used?

N.A. Not a capital project.

2. FAA Sec. 611(c). If contracts for construction are to be financed, will they be let on a competitive basis to maximum extent practicable?

N/A

3. FAA Sec. 620(k). If for construction of productive enterprise, will aggregate value of assistance to be furnished by the U.S. not exceed \$100 million (except for productive enterprises in Egypt that were described in the CP)?

N/A

C. OTHER RESTRICTIONS

1. FAA Sec. 122(b). If development loan, is interest rate at least 2% per annum during grace period and at least 3% per annum thereafter? N/A
2. FAA Sec. 301(d). If fund is established solely by U.S. contributions and administered by an international organization, does Comptroller General have audit rights? N/A
3. FAA Sec. 620 (h). Do arrangements exist to insure that United States foreign aid is not used in a manner which, contrary to the best interests of the United States, promotes or assists the foreign aid projects or activities of the Communist-bloc countries? Yes.
4. Will arrangements preclude use of financing:
  - a. FAA Sec. 104(f); FY 1986 Continuing Resolution Sec. 526: (1) To pay for performance of abortions as a method of family planning or to motivate or coerce persons to practice abortions; (2) to pay for performance of involuntary sterilization as method of family planning, or to coerce or provide financial incentive to any person to undergo sterilization? (3) to pay for any biomedical research which relates, in whole or part, to methods or the performance of abortions or involuntary sterilizations as a means of family planning; (4) to lobby for abortion? (1) Yes.  
(2) Yes.  
(3) Yes.  
(4) Yes.
  - b. FAA Sec. 488. To reimburse persons, in the form of cash payments, whose illicit drug crops are eradicated? N/A
  - c. FAA Sec. 620(g). To compensate owners for expropriated nationalized property? Yes.
  - d. FAA Sec. 660. To provide training or advice or provide any financial support for police, prisons, or other law enforcement forces, except for narcotic programs? Yes.
  - e. FAA Sec. 662. For CIA activities? Yes.
  - f. FAA Sec. 636(i). For purchase, sale, long-term lease, exchange or guaranty of the sale of motor vehicles manufactured outside U.S., unless a waiver is obtained? Yes.

g. FY 1986 Continuing Resolution, Sec.503. To pay pensions, annuities, retirement pay, or adjusted service compensation for military personnel?

Yes.

h. FY 1986 Continuing Resolution, Sec.505. To pay U.N. assessments, arrearages or dues?

Yes.

i. FY 1986 Continuing Resolution, Sec.506. To carry out provisions of FAA section 209(d) (Transfer of FAA funds to multilateral organizations for lending)?

Yes.

j. FY 1986 Continuing Resolution, Sec.510. To finance the export of nuclear equipment, fuel, or technology?

Yes.

k. FY 1986 Continuing Resolution, Sec. 511. For the purpose of aiding the efforts of the government of such country to repress the legitimate rights of the population of such country contrary to the Universal Declaration of Human Rights?

No.

l. FY 1986 Continuing Resolution, Sec.516. To be used for publicity or propaganda purposes within U.S. not authorized by Congress?

Yes, arrangements will preclude such use.

Government of the People's Republic of Bangladesh  
Ministry of Agriculture  
Section IV

No. Agri./IV/U-2/86/229.

Dated Dhaka the 16th June, 1986.

OFFICE MEMORANDUM

Subj: Proposed Home Based Area - Forestry Project under US-AID assistance.

The undersigned is directed to say that although a Community Forestry Project is currently under implementation in the seven old northern districts and a Second Social Forestry Project is now due for appraisal for nation wide implementation both with AID's assistance. In neither of these projects is there any provision for much needed research and related activities. The conceptual framework of community / social forestry demands an array of commensurate technological and research complementation.

2. For these reasons, over a year, technical discussions between this Ministry and the US-AID have been taking place on the conceptual framework and project design. The final draft of the project paper is now available and it was discussed in an intra-ministerial and inter-agency meeting on 26.5.86. The Ministry has accepted the project proposal in principle. A draft TP is also ready for presentation to the EPC shortly, prior to the submission to the Planning Commission. It may also be mentioned that on more than one occasion the Secretary, Ministry of Agriculture, has discussed this project with the Member (Agriculture), Planning Commission, who expressed his agreement to the need for this project.

3. The reason for this letter is that the US-AID local office has informally intimated this Ministry that its head quarter will not be able to project the indicative allocation for this project beyond

00000000/2

July 1, 1966, unless an agreement is signed prior to that date. This Ministry recognizes that formal request for funding to US-AID cannot be made prior to completion of the Planning discipline, which, it appears, cannot be accomplished by that date. Therefore, this Ministry requests External Resources Division to take up this matter with the US - AID at its earliest convenience, even if informally.

Sd/-

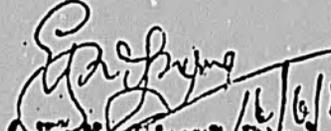
( K. M. Ejazul Haq )  
Joint Secretary  
Tele No. 40443

External Resources Division,  
(Attn: Mr. E. Allan Hill,  
Joint Secretary)  
Shor-E, Bangladesh,  
Dhaka

No. Agril./XV/U-2/86/229/1(5) : Dated Dhaka the 16th June, 1966.

Copy forwarded for information to :-

1. Mr. S. M. K. Burujal,  
Member - Agriculture, Planning Commission,  
Shor-E, Bangladesh, Dhaka
2. Joint Secretary ( E & D ), Ministry of Agriculture.
3. Joint Secretary (Forest), Ministry of Agriculture.
4. Assistant Secretary, Sec-XIII, Ministry of Agriculture.
- ✓ 5. Director,  
US - AID,  
(Attn: Mr. Allan Hill)

  
( K. M. Ejazul Haq )  
Joint Secretary

TECHNICAL ANALYSIS\*

Kenneth G. MacDicken

Manpower Analysis

This analysis is intended to describe the existing scientific capabilities at the Bangladesh Forest Research Institute (FRI), and to determine future requirements for agroforestry research.

Existing Scientific Capabilities

The FRI is organized into two research branches - Forest Products Research Branch, and the Forest Management Research Branch. Since the research portion of this project is largely production oriented rather than wood product oriented, the focus of this analysis is the Forest Management Research branch.

The Forest Management Research Branch (FMRB) has 10 divisions at present (Figure 2.1). Six have direct relevance to agroforestry research. These divisions are:

- Silviculture
- Minor Forest Products
- Forest Economics
- Genetics
- Soil science
- Seed orchard

Manpower is most often lacking in the senior and junior research officer categories, and this lack often results in excessive burdens being placed upon Divisional officers. The heavy work load of divisional officers such as the soil science divisional officer results in a number of projects which are not adequately completed, analysed or reported. Operational funding constraints such as the lack of travel funds further reduce the effectiveness of divisional officers and senior research staff. Best estimate available at this writing indicate that 12-14% of the sanctioned positions at FRI are vacant at present. Most of these vacancies appear to be in the research staff levels, not in support staff. It is not known if or when these positions might be filled, although the IDA funded strengthening project should help to resolve part of this problem.

Table E.1 Major on-going research project in FRI divisions directly related to agroforestry research

Division	Project name	Description	Date initiated	Duration
Genetics	Vegetative propagation of important forest tree species	To develop vegetative propagation techniques for Class 1 timber spp.	1980	on-going

\* A complete version of this report including sections deleted due to space limitations, is available in the project files.

Tree breeding and seed orchards To improve the quality of plantations through breeding programmes, seed stands and orchards on-going

Silviculture	IDRC Bamboo Project	Propagation, selection and improvement of bamboo species for mass propagation	1980	6 yrs.
	Species introduction and testing	To coordinate and conduct research on establishment of exotic and local tree spp. for a variety of uses through elimination, provenance, growth and pilot plantations.	1985	5 yrs.
Soil science	Land capability assessment and site classification	To assess land capability and classify site suitability for plantation establishment.	1985	
Economics	Strengthening of biostatistics unit	To provide a statistical design and analysis capability	1985	

A 1984 summary of active research projects in the Forest Management Branch lists the following projects for divisions which are involved in agroforestry related work:

Silvicultural Research Division

1. Measurement of seed production capacity of individual trees (No. 2/1 of 1968-69).
2. Determination of correct time and symptoms of maturity of seeds of ten important broad leaved species (No. 2/12 of 1968-69).
3. Studies on the growth and yield of bamboo clumps (No. 2/6 of 1972-73).
4. Studies on the growth and yield of Muli bamboc (no. 2/6.1 of 1979-80).
5. Establishment of an arboretum at the FRI campus (No. 165/3 of 1970-71).
6. Timber and community forest species trial in North Bengal. (No. 2/14 of 1977-78).
7. Growth trial of Eucalyptus species (No. 2/16 of 1978-79).
8. Provenance and plantation growth trials of bamboos (no. 2/18 of 1978-79).
9. Study of silvicultural characters and planting techniques of fast-growing industrial species (No. 2.9 of 1977-78).
10. Multi-use of Sal Forest Land (No. 2/2 of 1977-78).
11. Planting technique of Sal (No. 2/12 of 1979-80).
12. International provenance trials of Pinus oocarpa and Pinus caribaea (No. 2.19 of 1978-79).

13. Growth trials of Pinus (No. 2/19 of 1980-81).

Seed Orchard Division

1. Selection of provisional plus trees
2. Mapping of natural distribution of species
3. Selection of seed stands (Bo. 232/3 of 1977-78)
4. Establishment of clonal seed orchards (No.232/4 of 1977-78)
5. Establishment of clonal banks (No. 232/5 of 1980-81)
6. International provenance trials of teak and gamar (No. 232/6 of 1980-81)

General Section of Seed Orchard Division

1. Studies on the vegetative propagation techniques for important tree species (No. 165/1 of 1970-71)
2. Selection of fast-growing seedlings and their multiplication (No. 165/3 of 1976-77).
3. Studies of the breeding system of indigenous forest tree species (No. 165/3 of 1977-78).
4. Studies of the degree of fluting in progeny originating through vegetative propagation of teak (No. 165/10 of 1979-80).
5. Studies on the cytology and cytogenetics of important forest tree species (No. 165/11 of 1982-83).
6. Studies on the tissue culture techniques required for the important forest tree species (No.165/12 of 1982-83).

Forest Ecology Section of Seed Orchard Division

7. Studies on the periodicity of vegetative and sexual phases of Bamboos, Canes and Forest Trees (No. 118/3 of 1977-78).
8. Studies on seed production, dormancy and viability of bamboos and canes (No. 118/4 of 1979-80).
9. Study of the ecological changes in planted forest in order to help in management practices (No. 118/7 of 1980-81).

Bamboo Propagation Section of Seed Orchard Division

10. Vegetative propagation of bamboos (No.165/1 of 1980-81)
  - i. studies on the easy production of pre-rooted (adventitious roots) and pre-rhizomed branch cuttings.
  - ii. studies on the performance of pre-rooted and pre-rhizomed branch cuttings.
11. Studies on out-of-phase flowering in bamboos (No. 165/2 of 1980-81).
12. Studies on induced flowering of bamboos (No. 165/3 of 1980-81).

Soil Science division

1. Studies on the effect of important tree species on soil development and on soil protection (No. 114/1 of 1970-71).
2. Determination of the nutrient status of surface soils under monoculture of teak (N. 114/1.2 of 1977-78).
3. Determination of foliar composition of different tree species and the rate of organic matter accumulation in soil under these species (No. 114/1.5 of 1976-77).

4. Study of the nutritional requirements of some important forest species at the seedling stage (No. 114/2 of 1974-75).
5. Diagnosis of visual symptoms developed on Chapalish seedlings due to nutrient deficiency (No. 114/2.1 of 1975-76).
6. Semi-detailed soil survey of Forest Reserves, Silvicultural Research Stations and Sub-stations and Seed Orchard Centres (No. 114/4 of 1975-76).
7. Studies on the effect of increased salinity of river water on the soil salinity of the Sundarbans and other coastal areas (No. 114/5 of 1976-77).
8. Land evaluation for the cultivation of rubber and oil palm on hilly terrain and the nutritional requirements of rubber and oil palm seedlings (No. 114/6 of 1982-83).
9. Collection of soil monoliths from representative forest soils of Bangladesh (No. 114/7 of 1982-83).
10. Study of the pedogenesis of soil based on the bulk density distributions in a vertical direction (No. 114/8 of 1982-83).

#### Minor forest products division

1. Collection, identification and multiplication of medicinal plants (No. 89/2 of 1980-81).
2. Propagation and cultivation of minor forest produce and economic plants and establish a source of their propagating materials (No. 89/3 of 1980-81).
3. Survey, identification and cultivation of canes (*Calamus* spp.) of Bangladesh (No. 89/4 of 1982-83).

#### Forest economics division

1. Cost-benefit analyses of forest plantations in Bangladesh (No. 6 and 7/1 of 1981-82).
2. Economic analysis of Agroforestry in selected places of Chittagong Hill Tracts, Chittagong and Cox's Bazar Forest Divisions (No. 6 and 7/2 of 1982-83).
3. Compilation of important timber prices in Bangladesh (No. 6 and 7/3 of 1977-78).
4. Determination of recovery rate in sawmills of Chittagong (No. 6 and 7/5 of 1981-82).
5. Determination establishment cost of plantations in hill forests.

A number of these studies have not yet been summarized, analysed or reported. Operational budget constraints to data collection have been cited as a cause for some of the delays in completing research projects. Provision of adequate operational resources for transportation, field investigators and supplies would remove many of the constraints to greater utilization of physical facilities and of the existing scientific manpower.

#### Future Manpower Requirements in Agroforestry Research at FRI

Agroforestry research at FRI needs to provide information for agroforestry practices on government controlled public lands as well as to provide component technology research in specific areas for use on private lands. At present, there is no central institutional focus for agroforestry related research. It is strongly recommended that an

Agroforestry Research Division on par with the 10 existing Divisions be established at FRI to coordinate agroforestry related research, and to conduct research which is uniquely classified as agroforestry. Examples of the types of tasks this division might undertake are given in Section 3.

Manpower requirements for this new division would include:

- 1 Divisional Officer
- 1 Senior Scientific Officer
- 1 Junior Scientific Officer
- 4 Field investigators
- 10 Support staff

This staff would be supported by two expatriate specialists - one agroforestry expert, and one social scientist. A major task for these individuals would be to assist in the review, summarization and interpretation of study results. Many of the studies listed in Section 2.1 would provide valuable data for agroforestry practice and for future research efforts.

The provision of additional manpower for an agroforestry division must be accompanied by adequate operational support for travel, data collection, analysis and interpretation. It is assumed that this project will provide a portion of this support.

#### Indicative Plan for Agroforestry Research

This section outlines one possible combination of agroforestry related research activities to be carried out in conjunction with this project. The individual examples of experiments are only to be used as a guide to the types of research which need to be conducted to support agroforestry field activities.

#### Introduction

The general approach for strengthening agroforestry research in Bangladesh is to include the following activities:

1. Agroforestry research to be carried out on existing Farming Systems Research Sites throughout Bangladesh. This research will place heavy emphasis on homestead plantings, but will also include experimentation with promising agroforestry planting schemes on crop lands and field margins;
2. Component technology research and development through several existing research institutions. Forest tree and forage research will largely be conducted by the FRI, with horticultural research carried out by BARI and BAU. This work will be carried out on regional sites and will be closely coordinated with FSR sites in each region;
3. Specialized research which is beyond the scope of existing organizational mandates will be performed through a contractual research arrangement administered through BARC. This will include

both technical and social science research and will also provide funds to PVOs for demonstration trials (Section 4).

The research process envisioned for this project includes the following general steps:

- Year 1 - Setting of end-use objectives for agroforestry research. This will require review of village forestry surveys, sociological data on farmer attitudes, and an assessment of felt needs for food, fuel, fodder, and wood products;
- Establishment of criteria for contract research projects on agroforestry. Major areas of research thrust will include fuelwood, fodder, fruit, and construction materials. This will include priority setting for research projects based upon end-use objectives;
- Year 2 - Initiation of field research. This will include immediate planting of existing improved plant materials on FSR sites, and initiation of component technology design and testing on the FRI, BAU, and BARI sites;
- Years - Testing of newly developed or refined component 3 to 5 technologies on FSR sites.
- Continued refinement of both component technologies and agroforestry combinations through interaction between farmer and farming systems site personnel and between FSR site staff and research institution staff.

The setting of research priorities must be accomplished early in project implementation. BARC has already set general priorities for agroforestry related research in Bangladesh (Table 3.1), which will need to be reviewed and revised as additional information is analysed from the FSR surveys and social science research.

Table 3.1 BARC priorities for agroforestry and related research

BARC Research Program	Description
Agroforestry and Khas land development	
High Priority areas	<ol style="list-style-type: none"> <li>1. Description and inventory of homestead agroforestry and khas lands</li> <li>2. Improvement of nursery stock and practices</li> <li>3. Selection of appropriate trees for single or multiple purposes</li> <li>4. Studies on the comparative economics of different forest trees, fruit trees, shrubs, crops, poultry, and livestock</li> <li>5. Development of appropriate agroforestry systems for the Hill Tracts</li> </ol>

- Medium priority areas
1. Studies on practical management for sustained production
  2. Studies on possible solutions to legal constraints in the development of Khas lands
  3. Socio-economic studies on shifting cultivators and the development of practical programmes to integrate them in appropriate agroforestry systems.
- 

### Fruits and nuts

- High priority areas
1. Improvement of vegetatively-propagated fruits through clonal selection
  2. Identification and selection of mother plants to establish high yielding, superior clonal stocks
  3. Find suitable propagation techniques
  4. Develop improved production practices
  5. Studies on insect pests and diseases
  6. Post-harvest physiology
- 

- Medium priority areas
1. Introduction, collection and evaluation of germplasm
  2. Development of improved hybrid varieties
  3. Studies of soil-water-fertility relationships
  4. Studies on production economics and marketing
- 

### Forestry

- High priority areas
1. Selection of adapted indigenous and exotic species of bamboos for different regions or conditions
  2. Development of simple propagation techniques for bamboo
  3. Selection and evaluation of fast-growing and high-yielding forest tree species
  4. Studies on watershed forestry, agroforestry, and community forestry
- 

- Medium priority areas
1. Development of nursery and plantation techniques to service large-scale plantation programmes
  2. Classification and evaluation of forest soils, and the selection of appropriate tree species for different soil types
  3. Development of appropriate canopies to harvest maximum sunlight by growing different species of forest plants in terraces
  4. Control of bamboo blight
  5. Improvement of bamboo cultural management
-

Fodder, Feed and animal nutrition

High priority areas	<ol style="list-style-type: none"><li>1. Survey of available and potential feed and fodder resources</li><li>2. Studies of local and exotic pasture forages</li><li>3. Studies on the selection and agronomic characteristics of suitable species and varieties of fodder</li></ol>
Medium priority areas	<ol style="list-style-type: none"><li>1. Studies on the possibilities of saving nutrients by organic recycling</li></ol>

Since several research institutions will be conducting agroforestry research in different locations, and on different topics, the coordination of activities becomes critical.

I have made the following assumptions:

1. Participating FSR sites will be provided with core budget support through BARC for farming systems research on agroforestry.

2. Major research activities will be funded directly. For example component technology research at FRI will be supported through project funding.

3. Research activities should begin as soon as possible to accelerate the flow of benefits to farmers. Research is seen as a prerequisite to significant improvements in homestead agroforestry practice. Linkages to government and private nurseries should be made to facilitate the flow of improved planting materials which result from research.

4. Project related research work may begin prior to delivery of commodities and technical assistance. Pre-project training in agroforestry will help prepare research personnel for project activities.

5. Component technologies which are already in an advanced stage of research will be tested on farming systems sites at the earliest possible date. Examples of these technologies include the use of the tree species Leucaena leucocephala, Eucalyptus camaldulensis, and Acacia mangium and pigeon pea (Cajanus cajan) in agroforestry cropping patterns.

Farming Systems Research

Farming systems research has been selected as a major means of identifying and testing appropriate agroforestry approaches on homestead and agricultural lands. Cropping systems research has been carried out by a number of government and non-government institutions on some 30 sites in Bangladesh over the last ten years (approve). While not all of these sites are active at present, 12 sites have been tentatively identified as being most suitable for initial work on agroforestry (Table E.2). This listing is only suggestive of an approach which concentrates technical efforts on FSR sites which are both active and in appropriate institutional and social environments for effective agroforestry research. Institutes in which

primary interest is in a single crop or regions where homesteads are highly developed are examples of FSR sites which might be initially avoided.

Component technologies are defined as agricultural technologies which relate to a specific portion of the farming system. An example from rice culture might be the development and or testing of rice varieties, or the determination of optimum rates of fertilizer application. An example from homestead agroforestry might be the identification, screening and development of suitable or improved varieties of a light shaded multipurpose tree such as Sesbania grandiflora for use as a food, fodder, and fuel source.

These component technologies would be initially developed by cooperating institutions such as BARI and FRI in close cooperation with the FSRS agroforesters and technical support personnel. The responsibility for on-farm testing of component technologies will be primarily with FSRS staff.

Table E.2 Potential Farming Systems Research Sites (FSSs) for agroforestry

Site	District	Institute	Regional agroforestry support station
<b>Year 1</b>			
Hathazari	Chittagong	BARI	FRI - Chittagong
Trishal Thana	Mymensingh	BAU	BARI - Joydebpur
Laharikanda	Jamalpur	BARI	"
Manikganj	Dhaka	BJRI	"
<b>Year 2</b>			
Bogra	Bogra	BARI	BARI - Ishurdi
Rangpur	Rangpur	BARI	"
Bhagepara	Jessore	BARI	"
Kalikapur	Ishurdi	BARI	"
<b>Year 3</b>			
Vaskarkhilla	Kishoreganj	BJRI	BARI - Joydebpur
Sripur	Sripur	BRRI	"
Nather Pathua	Comilla	MCC	FRI - Chittagong
Tetuaya	Comilla	MCC	"

The number of farms on which research will be undertaken will also dramatically increase with the establishment and development of Multi-Location Test sites (MLT). BARI has designated over 80 of these MLT sites to be associated with the FSR sites throughout Bangladesh. These MLT sites are designed to utilize FSR site personnel to extend specific experiments to new locations, thus greatly increasing the area covered by each FSR site. If this expansion program is successfully implemented, the number of locations at which agroforestry component technologies will be introduced through this project will be greatly increased.

The following are examples of the types of research which might be conducted at the FSR sites:

- identification and classification of existing planting patterns on homestead sites
- characterization of existing agroforestry practices on crop lands and field margins
- design and introduction of improved planting schemes
- testing of the effects of simple management practices such as pruning on wood, fruit, and fodder yields of various tree species
- testing of component technologies such as improved varieties of mango and jackfruit
- species and provenance testing of short-rotation fast-growing trees
- yield and management trials of ground cover crops such as napier grass, Dolichos spp. etc.

An example of the specific types of research to be conducted on homestead sites through the FSR sites would be: Homestead production from pigeon pea (Cajanus cajan)/napier grass cropping patterns

Duration: 3 years

Suggested experimental treatments:

- 1) Spacings: Evaluation of intercropping combinations for food, fodder, and fuel
  - a) Intensive cultivation of pigeon pea with napier understory
  - b) Widely spaced pigeon pea plantings with napier as primary product
  - c) Variety x spacing trials
- 2) Homestead management techniques: Assessment of the effects of commonly used practices on grain, fuel and fodder yields
  - a) Lopping and pollarding for fuel and fodder production
  - b) Varietal screening for pigeon peas best suited to intercrop management

An example of research to be conducted on agroforestry practices on crop lands would be:

Research topic: On-farm production of babla wood (Acacia nilotica)

Duration: 3 years

Suggested experimental treatments:

- 1) Spacings: Evaluation of population densities for optimum production of wood and grain crops
  - a) Evaluation of crop yield responses to planting babla on crop lands

- b) Growth and yield studies of babla at 20, 40, 80, and 160 trees per bigha
- 2) Management techniques: Assessment of the effects of management practices on grain and wood yields
  - a) Fuelwood yields from lopping at different intensities during growing period and at harvest age (e.g. 2-3 years)
  - b) Effects of lopping babla branches on intercropped grain yields

The major advantage of the FSR approach in this project is that it allows research on homestead sites which are generally man-made sites not found on any research station. The uniqueness of these soils and the way in which they are managed requires actual on-site testing of all agroforestry technologies which are sensitive to soil characteristics. There are at least 3 forest tree and two ground cover species (Leucaena leucocephala, Eucalyptus camaldulensis, Acacia mangium, Stylothanes, and Dolichos) which have been extensively tested at FRI and could be tested on homestead conditions without further delay.

#### Forestry Research at FRI

The potential role of the Bangladesh Forest Research Institute (FRI), in the future of agroforestry research is best planned to optimize existing institutional and professional interests and capabilities. At present none of the staff of FRI are engaged in agroforestry research or implementation. However, there are several scientists who have expressed interest in various aspects of agroforestry, and who have conducted research in areas of importance to agroforestry (e.g. bamboo and jackfruit propagation, species testing).

It is proposed that these interests be encouraged and supported through the creation of an Agroforestry Division within the Forest Management Branch of the FRI. At present this branch of the FRI has 10 divisions with some 84 full time professionals (Section 2). The major tasks and responsibilities of this new division would include the following:

- review and summarization of FRI research which relates to agroforestry
- agroforestry research planning for new research projects
- coordination of research activities with other FRI divisions
- design and implementation of agroforestry field trials at the Silviculture Research Stations
- cooperative programs with agricultural research institutions working in agroforestry
- field oriented agroforestry research on government forest lands
- support FSR sites in farming systems research on agroforestry

The facilities of FRI including the Silviculture Research Stations, Seed Orchard Centres, and main campus laboratory and propagation facilities would be used by the Agroforestry Division to do component technology research. Suggested research topics would include:

- Propagation of fast-growing tree species and bamboos
- Pollarding, lopping, pruning and coppicing of important agroforestry tree species
- Mixed plantings of nitrogen-fixing tree species and non-nitrogen fixing species, including shrubs and annual crops
- Cultural practice improvement
- Soil nutrient and water uptake studies
- Continued testing and improvement of the ground cover legumes Stylothausas and Dolichos, and grasses such as Guinea and Napier grass
- Species trials which include commonly used homestead tree species such as Bombax caiba, Erythrina indica, Samanea saman, Albizia procera and others
- Advanced studies of mass propagation of bamboos
- Selection and breeding of promising agroforestry species such as Sesbania grandiflora, S. sesban, and Acacia nilotica
- Seed production, collection, storage and dissemination

One physical limitation to agroforestry research by FRI which is relevant to private lands is that the Silviculture Research Stations (SRS) are located on sites which have very dissimilar soils to those found on most homestead and farm lands. Care must be taken to avoid planting experiments on the SRS which are very sensitive to soil characteristics. For example, it would be unwise to establish species trials on the marginal hill lands at an SRS when the objective is to compare growth rates of species to be used on the anthropic mounds of most homestead sites. More suitable experiments for these sites might include lopping, or coppicing, or propagation trials, which while not entirely insensitive to changes in soil characteristics, are generally far less sensitive than species or provenance trials.

#### Agriculture and Horticulture Research

Several BDG agricultural research institutions are capable and interested in participating in agroforestry-related research. While the FRI will be responsible for the forestry related component technology research cited above, agricultural research institutions will be encouraged through project activities to develop and test specific agricultural-based technologies for agroforestry. Institutions which might be directly involved include:

Bangladesh Agricultural Research Institute (BARI) - The Bangladesh Agricultural Research Institute (BARI) carries out a wide range of basic and applied research with oilseeds, wheat, pulses, vegetables, horticultural crops and others. BARI has 6 FSR sites in operation, with an additional 5 FSR sites selected and listed as pending. In addition to facilities at the central station at Joydebpur, BARI has 4 regional stations, 10 sub-stations, and 5 special crop stations.

BARI has perhaps more facilities suitable for agroforestry research than any other single research institute in Bangladesh. This is particularly important given the importance of FSR in the present design. Specific areas to which BARI might contribute to the agroforestry research of this project are:

- o farming systems research at the 6 active BARI FSR sites
- o component technology development at the Regional stations and sub-stations, with special emphasis on fruit trees and pigeon pea research

While specific research responsibilities will need to be worked out in greater detail during the early stages of project implementation, BARI might take primary responsibility for clonal improvement of jackfruit and mango species in cooperation with Regional Stations and its special Mango Research Centre.

For example, specific study topics might include the following experiments:

Research topic: Homestead jackfruit (Artocarpus heterophylla) production methods

Duration: 6-8 yrs.

Suggested experimental treatments:

- 1) Establishment methods: Evaluation of establishment techniques and the economics of various propagation methods
  - a) Propagation by seedlings and direct seeding
  - b) Vegetative propagation by grafting, cuttings, and layering
- 2) Homestead management techniques: Assessment of the effects of commonly used practices on early fruit, fuel and fodder yields
  - a) Lopping and pollarding for fuel and fodder production
  - b) Fertility management studies with potentially available ammendments (e.g. manure, coconut husks)

Bangladesh Agricultural University (BAU) - Bangladesh Agricultural University (BAU) at Mymensingh also conducts a wide range of basic and applied agricultural research. Research facilities include limited laboratory facilities, a main campus research farm, horticultural garden, and FSR site. Faculty are involved in a variety of research areas relevant to agroforestry, the most important of which appears to be in the horticultural field. Specific areas of research which BAU faculty might carry out with project assistance would include:

- o genetic improvement of mango and jackfruit
- o management studies of important homestead fruit tree species
- o insect and disease pest management
- o crop interactions in agroforestry

BAU researchers would need to work closely with BARI horticulturists early in project implementation to define specific research responsibilities for important fruit tree crops.

An example of the type of research which BAU might conduct would include:

Research topic: Crop interactions between important homestead agroforestry species

Duration: 4 years

Suggested experimental treatments:

- 1) Growth and yield of crops in various combinations
  - a) Effects of intercropping different herbaceous crops on tree growth
  - b) Effects of various tree crops on yields of homestead cover crops

Soil Resource Development Institute (SRDI) - The Soil Resource Development Institute (SRDI) is actively involved in the characterization, classification, and mapping of soils in Bangladesh. While all of Bangladesh has been covered by soil mapping, these surveys have been entirely geared to crop and forest lands. No studies of homestead sites have been conducted to date. Given the unique nature of these sites and the fact that very little is known about them, it is important that some characterization work be done as soon as possible. This research could profitably be done cooperatively between SRDI and the Soil Science Division of FRI.

Specific studies by SRDI might include:

Research topic: Characterization of homestead soils

Duration: 2 years

Suggested activities:

- 1) Classification of a variety of homestead soils
- 2) Analysis of the physical and chemical characteristics of homestead soils
- 3) Identification of soil (edaphic) limitations to tree growth on homestead sites

Other institutions - Several other institutions are involved in research which is relevant to agroforestry. These include:

- Bangladesh Jute Research Institute (FSR sites)
- Bangladesh Livestock Research Institute (formerly the Directorate of Livestock Services - forage production)
- Bangladesh Tea Research Institute (fast-growing tree plantings)

Provisions for making small research grants to these institutions are discussed in Section 4.

Coordination of Research - Agroforestry research covers a very broad range of substantive areas and requires a number of different specializations in both the biological and social sciences. The combination forestry, horticulture, agronomy and soil science research requires close coordination if these efforts are to be successful. The responsibility for research program coordination for this project will be carried out by the Bangladesh Agricultural Research Council (BARC). For a description of the institutional arrangements between BARC and the participating research institutions see the Institutional section.

## SOCIAL ANALYSIS

Kay Mitchell Calavan

### Types of Village Homesteads

In my rapid rural appraisal interviews in several villages I tried to talk to representatives (men and women) of households at different socio-economic levels and to walk around the village area and ask general questions. From this information and interviews with professionals who have been working with villagers (e.g., FSS staff and NGO staff from MCC, RDRS, and CRWRC projects) I found that it is not particularly useful to think in terms of a general "Bangladeshi villager", rather to consider about five types of village homestead owners. Each homestead type has a different configuration of land resources, income generating activities, household pressures on the homestead, and attitudes toward more intensive homestead use. Below I present examples of each type of household. This is not done to present an exhaustive list of village household types, but to suggest the kind of preliminary analysis or sorting of village homesteads that proposed FSS agroforestry staff will need to do to effectively address the interests and capacities of village households.

#### 1. Absentee Landlords

One group with limited day-to-day interest and participation in many Bangladeshi villages, but with large homestead and cultivable land holdings are absentee landholders who work and live in Dhaka or other large towns. My two assistants (recent graduates of Dhaka University) took me to their home villages in Brahmanbaria and Chittagong District. In the first case the family owned a two acre homestead (including tank, mosque, cemetery, and other land) and 26 acres of field land. In the other case, the family owned a five acre homestead (including two house sites, six adjacent tanks, and associated land) and 40 acres of field land. Both families, members of the traditional rural elite in their districts, had moved to Dhaka a generation ago, when my assistants' fathers were educated in the city and continued working there. The children have grown up in the cities and now know little about their home village lands. I suspect that many Bangladesh villages have such absentee landholding families. Many of these families have allowed caretakers to stay in their village houses, but these have not been very aggressive in protecting the property interests of absentees or intensifying production.

Under these conditions (as we discovered in the Brahmanbaria and Chittagong villages), these homestead and tank areas have been treated by other villagers as village "public" resource areas, and used to relieve population pressure on their own homesteads. For example, in Brahmanbaria we interviewed several poor families that had established house sites next to the road on the absentee landowner's land. They have claimed this land for two to twenty years and have not been challenged by the landowner. We also found villagers fishing and harvesting water hyacinths from tanks and ponds on the land; grazing their cattle on the old homestead; scavenging

leaves, twigs, and branches; and cutting down trees. Also, villagers were using the landowner's family cemetery for graves and beginning to claim trees in that area.

In Chittagong, people were also using the homestead, tanks, and cemetery as a common public area for collecting, grazing, and cutting trees. Particularly around the six tanks on this absentee landowner's homestead, most trees have been felled.

A major issue for this project is that this type of homestead land may be a significant portion of the total homestead area of a village, but its biological stock is being systematically degraded by common cutting and collecting, without any effort at replanting or increasing low productivity levels.

Some FSS officers have also mentioned that they are sometimes unable to obtain participation of larger landowners in their areas because they are absentee landlords or have other interests. Cooperating farmers are usually drawn from the medium landholding group. This problem of absentee landowners seems to be even more serious in the Rajshahi Barind Tract, which consists of very dry, deforested, high land. It is reported that most landowners live in the river valleys. There are few permanent share-cropper homesite or bari areas since the sharecroppers reside and work in the dry areas only during the single cropping season. One FSS officer who has worked in that area commented that, in order to initiate some cropping research, he had gone to the district town to talk to an absentee landholder to interest him in the research project.

This pattern of absentee landholding may be changing for some families. Members of the to families I described above have recently taken greater interest in their family landholdings. They have supported increased crop land productivity by buying water pumps, better seed, and other inputs. In one case the father is retiring from a civil service career in Dhaka and is repairing a house in the home village. Also, there are cases of well-to-do Dhaka families purchasing rural house and field sites nearer to Dhaka (e.g., near Savar or on the road to Mymensingh) and taking an active week-end interest in managing the planting of fruit trees, timber trees, and vegetables for family use and for sale.

The Homestead Agroforestry Project may want to set an objective of contacting these absentee owners and encouraging them to intensify production on their village homesteads. The project may want to consider matching the interests of these absentee owners with local marginal families who can be trained to work as nurserymen and managers of fruit orchards or timber stands in exchange for contracted share-use rights. These absentee owners will often own substantial non-crop land in a village suitable for establishing orchards which will provide local nursery stock. However, they will require resident managers and guards. Also, these absentee owners would have the capital to set up these orchards.

2. Educated Village Residents With Outside Income

Another important homestead type are households which reside in the village but are not full-time farmers. They are often better educated than other villagers and are in private business or have salary jobs with the government, institutes, or schools. They live in villages near district towns which provide markets for items such as fruit, vegetables, and tank fish.

The staff at the BAU FSS near Mymensingh noted that there was a high education level among the residents of the first three villages they surveyed and that many of these people worked in the town. At the FSS site near Ishurdi (Kalikapur) we talked to a local resident and entrepreneur who had recently moved out to the village, bought two acres of field land, and created a bari homesite. He had a large tank excavated and built up a house and garden mound. He was truck-gardening vegetables in a year-round sequence and planting lemon and guava trees around the tank. He did not want to plant large trees around the tank which would shade it and reduce microflora for fish. He was very interested in smaller fruit trees and light-canopy timber trees such as ipil-ipil. He had excluded livestock from his homesite production scheme and placed a large bamboo fence around the homesite to protect his plants. Staff of the FSS had started a new homestead production research program and were working with this man and some poorer local residents who had requested assistance.

Another group of potential village entrepreneurs who have village land and sufficient capital to start intensive homestead production of trees and vegetables are the families of village men working in the Middle East. I did not find any village informants in this category but I expect that many of these families are looking for small scale activities in which to invest remitted funds.

Beside the major roads I saw several interesting small scale orchard and garden production schemes. Because of time constraints I was not able to stop and interview people at these sites, but I will list these observations because there may be some followup contact with local entrepreneurs in the development of this project.

LOCATION	ACTIVITY
Road from Bogra to Rangpur	Several banana plantations 1/4-1/5 ha; 90-200 trees
Jessore and Kushtia	Reported banana plantations
Mirsharai to Chittagong	Dense <u>shim</u> plantings on poles around fields or covering fields
Belabo area in Narsingdi District	Jackfruit orchards on high land (some with grain and pulse inter crops)

Rajshahi-along river	Reported commercial mango orchards
Barisal	Reported coconut tree groves
Mymensingh area	Areca nut orchards
Road from Dhaka to Brahmanbaria	Betel-leaf production
Remote Village of Chittagong District	A 1/4 acre bamboo plantation on a homesite
Chittagong	Citrus orchards (lemon and lime)

These local entrepreneurs are actively seeking good commercial opportunities. They are not dealing with fuel and fodder concerns, but with increasing their income. They may be among the first in a village to be interested in trying improved technologies that FSS agroforestry teams will offer. Also, they may be more careful about maintaining seedlings and monitoring results. They could also operate private local nurseries. They may already have expertise with some tree crops which could be useful to this project. Finally, their commercial production schemes could generate some jobs for other villagers.

### 3. Surplus Farming

These farmers usually own three acres or more of field land, reside in the area, and focus on crop cultivation as their prime occupation. These are often the cooperator farmers of the FSS. I talked to three such cooperating farmers near the Rangpur FSS. They stated they did not have to buy any fuelwood. They mainly used jute sticks for fuel. Also, after the winter crop harvest, they used wheat straw for fuel; this straw gives a better fire and leaves rice straw to be used as fodder and compost. They had enough cultivated land to be self-sufficient in crop residues for fuel, fodder, compost, and to sell. They also had sufficient homestead trees to provide branches for firewood for themselves and to sell to neighbors.

One farmer has 36 decimals of homesite land and about 25 trees including fruit, timber, and bamboo trees. Each time he cuts a tree he replants a tree. He prefers to plant mango and jackfruit trees and buys the seedlings at the Rangpur Horticultural Base Nursery or from local market sellers. Also, foresters had visited his bari near the main highway and gave him some timber seedlings to plant. However, the only ones that survived in the village were ipil-ipil and acacia. Another farmer said he had a one acre homesite with many types of trees (e.g., bamboo, mango, jackfruit, bitternut, lemon, and coconut). He had enough trees that he did not bother to replant seedlings when he cut one down. Another farmer said that he had several types of trees. When he cuts a tree, he plants two seedlings.

In a Brahmanbaria village I talked to a widowed household head who has three acres of cultivated land and 65 decimals of homestead land, which includes part ownership of a tank. She has about 15 trees on her homestead (including mangoes, 3 jackfruits, one blackberry or jam, one plum, and 2 bamboo clumps). At the time of our interview a bamboo worker was cutting some bamboo poles to use in weaving a wall panel. Her cattle were feeding on bamboo leaves. She said she rarely cut other trees on her homestead, because she has enough crop residues from three crops each year (jute sticks and rice straw) to supply fuel for two chula in her bari. She also has enough additional rice straw and other residues for fodder for her three cows. She planned to plant coconut seedlings to be able to sell green coconuts in addition to mangoes and jackfruit which she currently sells. She plans to buy the seedlings at the BADC nursery for Tk. 20/seedling. She also has a compost pile on the edge of her homestead which includes straw, cow dung, and other crop residues. She would like to plant more trees in the land surrounding the tank.

A third case is that of five brothers who own an acre of homestead land and a tank in a village near the BAU FSS at Trishal. They also own large parcels of crop land. They have enough crop residues and tree branches for fuel, and enough for fodder for their six cattle. They feed their cattle rice straw, pulse crop residues, and oil cakes. Also, in the rainy season they cut the grass between the jute rows for their cattle and feed them bamboo leaves. They have several trees around their houses, and on an adjacent area near their tank they have a small (about 1/5 acre) plantation of newly planted date palms, areca palms, and coconut palm seedlings.

These better-off farmers have surplus crop residues and lakri (precut firewood) that they sell on occasion to poorer villagers. In addition, in years with extensive flooding (such as 1984-85), they sell surplus rice straw to middlemen who sell it in central Bangladesh because of severe fodder shortages there. Regional market force conditions up local fodder prices.

These farmers are generally already planting trees and are interested in planting more and better varieties and talking to people with expertise on this subject. Some have their own small schemes for planting fruit and areca nut trees. They are in contact with the Horticulture Base Nurseries and sometimes the Forest Department Nurseries. Most of these homesteads have space available for more trees and other plants around their tanks. They do not want to plant tall, dense-canopy trees too close to tanks, if they are raising fish. Also, some of these farmers have a few "automatic" (naturally seeded) trees with light canopies in their fields and on roadsides adjacent to their fields. They may also have hardwood trees (e.g., jackfruit) available for cutting when necessary for constructing doors, windows, and furniture. Or they may purchase wood at woodshops or from neighbors when they need it.

#### 4. Small Farmers

This type consists of small farmers who cultivate less than three acres, are sharecroppers, or are doing a combination of these. They are beginning in this generation to feel family pressures on their homesteads and crop land resources. Often they are not self-sufficient in fuel or fodder materials for the entire area and conditions are generally worse in years of extensive flooding. In such cases they often sell one or more of their draft animals during the rainy season. Women and children of these families spend much time collecting twigs, branches, leaves, and grass from various "public" areas of the villages to supplement fuel and fodder supplies. These families have limited land available for planting more trees, but could plant some. They are interested in talking to people with expertise about tree husbandry and are more interested in fruit trees. This may be due to lack of knowledge about fast growing fuelwood or multi-purpose trees.

The first case is that of a farmer in Brahmanbaria who has four houses for himself and his three married children (total of 25 people) on a 40 decimal homestead. They have 1 and 1/2 acres of field land. They have 8 cows and 2 goats to feed. There are some trees around the homestead including a bamboo clump, a blackberry, and a small mango. He had cut one older blackberry tree to use for wood to make two doors and four windows for a house. He once tried to replant some tree seedlings but was not successful; he felt there were soil problems. He is interested in planting more trees and prefers fruit trees such as mango, jackfruit, coconut, and blackberry. This bari is near the Titas Gas fields and some residents have used gas burners for four years for cooking (cost Tk 500 for hook up and Tk. 45/month for one burner). This subsidized gas price has cut their fuel costs. They still have woodburning chulas for parboiling rice and some cooking. For fuel they use rice husks, branches lopped from their own trees, and some purchased lakri. The price range for lakri in the area varies from Tk. 35-50/maund, depending on the quality and dryness. This informant, as well as other villagers I talked to, said that the price of lakri had increased Tk. 5-10 from last year's price.

This family uses rice straw from their 1 and 1/2 acres of field land for fodder. They use aus and aman rice straw from the end of each harvest to the end of February. However, because of flooding there was less rice straw this year. When the rice straw runs out, the women and children begin cutting grass in the bhil, a depression area about 6km from the village. However, there is increasingly less fallow land in the bhil, because more landowners are raising rice in the winter season. (BKKI has been assisting landowners in this area to purchase pumps to raise in an HYV winter rice crop.) When the bhil area is flooded during July and August, this family collects green water hyacinths from village tanks and canals for fodder. Also, they purchase rice straw and rice bran from neighbors for fodder.

A second case is a farmer in Brahmanbari who has 1 and 2/5 acres of field land and a 22 decimal homestead. On this bari there are 3 houses with 6 adults and 3 children. They have some jute, aus rice, and boro rice

residues for fuel and fodder. However, they have to buy additional materials and collect other materials around the village. They used to have jackfruit and blackberry trees, but sold them to a neighbor who had doors and windows made from them. Recently they planted some mango, plum, and tamarind seedlings, and the whole family looks after them. They are interested in planting more trees.

A third "small farmer" case is a villager in Chittagong District who has 30 decimals of cultivated land and 20 decimals of houseland. This family raises enough aman and boro rice straw for half the year. They only cook twice a day. They have to gather leaves, twigs, and sticks, and buy lakri for half the year. The housesite now has 4 mango trees, 1 plum, and 1 clump of bamboo. They have space to plant more trees but would like advice on planting and maintenance of these trees. The farmer was interested in planting jackfruit, mango, and segun.

One regional variation is that in the southern part of Dhaka District and in Barisal and Khulna Districts where there are low fields and deep flooding traditional rice varieties with very tall stems are grown. Although grain yields are lower with this rice, straw yields are much higher. Villagers cut the top 3 feet of straw for cattle fodder and can use the bottom 3 feet for household fuel or sell it to local potters or local brickfields for fuel.

##### 5. Marginal or Landless Villagers

These farmers are sharecropping so little land (or no land) that they do not produce enough crop residues for fuel and fodder. Also, their homesteads have been subdivided to the limit; they are filled with houses, a small shared drying and threshing area, and an animal tethering area. There are few, if any, trees remaining on the homestead. If there are any animals they often have to be sold when fodder runs out. The men are typically involved in day labor and may bring in bamboo shavings or other fuel and fodder materials as part of their pay. The women and children make daily searches for fuel and fodder resources in "public" areas of the village. These "public" areas for gathering include village tanks and canals, roadsides and paths, mosque walls, school yards, cemeteries, absentee landowner homesteads, and fallow fields. They cut minuscule rice stubble or sparse grass in fallow fields; collect leaves, bark, and twigs around trees; gather cow dung; and cut green or dried water hyacinths.

One case in Brahmanbaria is a family of 11 members with 3 decimals of houseland containing 2 tiny houses and an animal shelter. The household head drives a rickshaw part-time and sharecrops 1 and 1/2 acres. He gets rice straw from aus and aman crops and uses this straw for roofing repairs, fuel, and fodder. The 1984 floods greatly reduced the amount of rice straw available. Starting in early February and continuing to August, his wife and children have to cut grass daily for fodder and collect fuel materials. It is more difficult to find grass with less local fallow land, and there is more quarrelling now between children from village families who compete for the same scavenging resources. Also, the household head says he sometimes has to go out at night and cut wood along other people's homesite

fencerows. They sometimes buy precut firewood in the rainy season and rice bran for the cattle. Last July he sold 3 cattle during the flood and then he purchased 2 cows after the aman rice harvest.

This family has 1 large acacia tree from which they have been lopping branches for several years. In addition, there are 2 plum trees and a silkori tree which he plans to sell after 10 years. He and his wife have recently found some "automatic" seedlings by the roadside and transplanted them to their small homesite. Also, since the homesite is near the village cemetery (actually owned by the absentee landlord), the household head is protecting some naturally seeded silkori tree seedlings there that he is claiming as his own. There is not much room on this homesite, but both the household head and his wife are interested in learning more about homesite tree production.

Another case is a Brahmanbaria family with 6 brothers and their families (total of 44 persons) on 30 decimals of homesite land. The homestead is filled with 6 houses, an animal tethering area, a central drying floor, and 2-3 trees at the edge of the site. These people pointed out that they had very little land on which to plant trees, and they had tried to plant seedlings near the roadside. However, they could not protect the seedlings from passing cattle and goats and didn't have enough money to construct a protective bamboo fence. They sharecrop a limited amount of land and receive some rice straw which is mainly fed to the cattle. The rice husks are burned as fuel. This year, because of the flood, the rice straw only lasted until mid-February. Then the children begin collecting grass in the bhil and in canal areas. Because there is less fallow land in the bhil now, the family will have to make up the fodder difference by collecting green water hyacinths from public areas and by purchasing rice straw and bran.

The women and children of this family were collecting dried water hyacinths from the dried-up canal when we were there. They said they require 3-4 baskets per day for cooking fuel in the winter months. Also, they collect cow dung and leaves. The family also buys small amounts of lakri for Tk. 8/ 4 kg for one day's cooking requirement. They have reduced the number of times they light their chula to two times a day. This was a frequent practice among other poor families we talked to.

A third case is two brothers in Chittagong District who have equally divided their father's 4 decimals of houseland. One brother is a sharecropper who raises only one aman rice crop on 30 decimals of land. There is not enough water for winter production. He has a family of seven. He obtains from his land rice straw for fuel and fodder for the October to December period. But his children begin collecting dried leaves, cowdung, sticks, and bark in December, and he has to cut branches on other people's land (e.g., the absentee landowner's tank perimeters). He noted that the number of trees in the village area is decreasing with increased cutting and no one is taking the responsibility to replant seedlings. Because of this it is now more difficult to obtain fuel wood. He has to buy some fuel materials. He feeds his 3 cows rice straw and rice bran until mid-December. Then he puts the cattle to graze in fallow fields of the village

and buys some rice bran and wheat bran to feed them. He also cuts grass for them from a higher khas land area when the fields are flooded in the summer months.

### Craft and Local Industry Materials from Homesteads

There are a number of local industries competing for the fuel resources from rural homesteads. The rice millers who also parboil rice require the rice husks for fuel. Although the large commercial brickworks usually buy large lots of wood at Forest Department auctions, smaller village brickworks also use the following items sold by villagers: jute sticks, rice straw, bamboo branches, and homestead trees. In addition, Hindu potters need to obtain fuel to fire their kilns. Apparently some potters are going out of business because of the combined pressures of decreasing demand for clay pots (due to competition from aluminum and plastic products) and the increased cost of fuel and clay. Hardwood and bamboo are also needed for building construction, and timber is needed for making furniture and rickshaw bodies.

There are certain weavers that have traditionally used kapok fibre from village trees for weaving cloth, and mattress makers that use the kapok. I saw many kapok trees in baris and along road sides on the way to Tangail and Mymensingh and heard about famous Brahmanbaria kapok mattresses produced in local cottage industries.

Cane materials in villages are used for wall and fence construction and in brooms. There are several types of woven mats made from homestead materials. khezur pati mats are made from date and coconut palm leaves. Dhai (thicker woven mats used on the ground for ceremonies) is made from naul cane which grows in the villages. There is also a parti bet sleeping and eating mat made from the bet cane which grows in low areas. Finally, in Comilla District I talked with a group of Hindu villagers who make the very soft shital pati mat from a thin cane called mukta. They buy the cane from an adjacent village that has a large village tank with the cane growing in the low area around the inner slope of the tank. This cane can be transplanted but spreads naturally where it occurs. Also, on the road to Mymensingh I saw some low fields filled with this cane; a passer-by said it was used by the women of the near-by village to make mats. Many villages do not have this cane now, but may benefit from planting it around tanks, if there is mat-making expertise nearby.

### Work Tasks for the HAU

#### Introduction

The present research staff at the FSS include 1-3 scientific officers who are agronomists or economists and 3-6 field assistants. The proposed agroforestry component for the FSS sites would consist of a separate team with specialized agroforestry training as well as general agricultural training (see Section 3). They will have their own objectives and linkages but will work out of the same FSS office. They will exchange information

with the rest of the FSS staff and receive some site orientation from the current staff. They will focus their energies on the project extension objectives of increasing homestead production of fruit, fodder, fuel, construction, and craft materials.

The agroforestry research team at each FSS will consist of one agroforestry scientific officer (AFSO) who takes the lead in designing and managing research and at least two (eventually four) field assistants. At least half of the field assistants (one of two, two of four) should be women, because of the homestead or bari focus of the project and because of the current interest of many Bangladeshi rural women in homestead production. Although this specification of women's positions on the agroforestry team is a new element at the FSS, there are a number of reasons why this is an appropriate and feasible idea for this project (see section 4.1 .4 discussion). The reason for having as many as four field assistants is that some of the institutions operating FSS (e.g., BAU, MCC, and BARI) are currently expanding their research area from 1-3 villages adjacent to the FSS office to multilocation testing sites in adjacent upazilas. After the first year, the agroforestry research program will need to expand to those areas and will require additional field assistants.

In the following subsections seven task areas for the Homestead Agroforestry teams are discussed. In the final subsection the functions of a central support staff for the FSS agroforestry teams are outlined.

#### Local Site Orientation and Analysis

For the twelve currently active FSS sites, the new agroforestry team must become rapidly oriented to activities of the current cropping systems staff. They will offer information and discussion of areas of overlap in the local farming systems. To the past FSS staff focus on improving field crop yields, increasing the number of crops in the cropping system, and increasing income from field crops, the agroforestry team will add other farming system concerns such as increasing fuel, fodder, timber, and fruit production.

The agroforestry scientific officer, with the aid of his field assistants, needs to review previous village base line surveys, field block monitoring surveys, and cropping research reports to identify information already collected that is relevant to agroforestry trials. Some examples of relevant information are socioeconomic distribution of village households, landholding patterns, soil and climatic data, drop residue yields, and amount of fallow land under traditional and improved cropping patterns. This information will help the team to analyze local homestead production problems and define promising production trials. Also, they need to learn the history of previous FSS staff interactions with farmers in the locality, flooding and drought cycles, local market networks or opportunities, and significant local organizations (e.g., KSS, MSS, or BSS).

### Identify Research Priorities and Cooperator Households

The second task will be for the team to introduce themselves to local villagers and do a rapid homestead survey of items produced, how utilized, and other needs and interests of villagers in homestead production. Also, the team will do some semi-structured interviews with knowledgeable persons on such topics as "fodder possibilities and problems", "local fruit and timber market opportunities", "local expertise with tree crops", "local handicraft products", and "production activities of local organizations". There should be dialogues with potential cooperating families about what kinds of technologies and planting designs they are interested in.

### Design and Implement Specific Homestead Research Trials

The agroforestry team will arrange for the Soil Resource Development Institute to carry out base line soil testing of anthropic mound soils at selected homesteads. With information from all previous research and surveys, the team, with the help of an agroforestry support team, will design specific trials for certain homesteads, tanks, bunds, field margins, etc. The local team will arrange contracts with local cooperating families so that in exchange for free inputs (e.g., improved grafts and tree seedlings, fertilizer, protective cages, and technical advice), the cooperators agree to manage planted materials as specified, allow the field assistants to monitor the trials, keep simple records of yield (e.g., wood lopped off, fruit yields, and fodder harvested), and provide a demonstration site for other villagers. There should be 10-20 trials conducted in each village included in the research scheme, with no more than 20 trials per field assistant.

Some experiments that usefully can be carried out in the villages include:

1. Measure effects of site growth conditions.
  - test species and varieties on unflooded and seasonally flooded soils
  - test species and varieties under different soil and climate conditions at different FSS sites
2. Test tree and leguminous ground cover varieties for quantity of yield, quality of yield, early and late maturation or fruiting, resistance to disease and pests, etc.
3. Evaluate different propagation techniques for fruit trees (direct seedling, grafting, air-layering, budding, varying root stock ages, etc.) for maximal survival and fruit yield and faster production of fruit.
4. Evaluate management practices on fruit and timber trees (fertilizer and other soil amendments, lopping branches for fuel and fodder pruning, etc.).

## 5. Planting designs

- Intercropping leguminous cover crops as an understory crop beneath homesite trees
- Seasonal planting of cover crops and bush legumes on housesite mound slopes, tank slopes, and cemetery areas
- Intercropping leguminous cover crops in fields with jute and sugarcane crops
- Impact of intercropping leguminous trees (e.g., Acacia Nilotica) with light canopies on crop fields.

### Monitor Trials and Analyze Data

The agroforestry staff must keep careful tree and plant site histories for this research. It is admittedly difficult to keep track and eventually measure the fruit yield, for instance, of specific grafts on mango seedlings on particular homesteads with specific management practices. It is much easier to measure the yield of a single season field crop. A good, easy to understand, record keeping system must be started so that there is continuity in research trials in spite of the fact that individual staff members will leave or be transferred during the period of experiments.

The staff will need to set up a regular research site visit plan (monthly or bimonthly) to record the following data: survival of grafts, buds, and seedlings; tree height measurements; flooding and drought records; management activities; disease and insect problems; and various types of yield records (e.g., fruit, pods, fodder, fuelwood, cane, timber, and intercropped yields). Three quarterly interim summaries of data and preliminary analysis should be made each year, followed by a more detailed annual research report which includes the research plan for the next year. These reports will be prepared by the agroforestry scientific officer with help from field assistants.

### Production of Planting Materials

There are at least two government production and distribution systems which provide tree planting materials to Bangladesh villagers. One is the Forestry Department system consisting of: Seed Orchard Centres, Silvicultural Research Stations, and Community Forest Growth Nurseries. The latter two currently provide timber tree seedlings and selected fruit tree seedlings (e.g., mango, jackfruit, and coconut) for sale to villagers. These are not necessarily improved varieties. Community Forest Growth nurseries are active in the Northwestern districts because their activities are part of the ADB Community Forestry Project.

Another government system for tree seedling production is the Horticultural Base Nurseries and regional orchards (e.g., adjacent to the BARI Regional Research Stations at Hathazari and Jamalpur) of the Department of

Agricultural Extension. There are four regional orchards with fruit tree stock covering more than 40 acres each. There are also smaller Horticultural Base Nurseries; 20 of them are in the 10-40 acre size range and other are less than 10 acres. To manage these there are four Horticulturalists, 20 Assistant Horticulturalists, and other nursery supervisors.

MCC, an NGO that has operated a horticultural extension program in Noakhali and Comilla Districts for one year, has already used the Horticultural Base Nurseries as a production source for grafted mango seedlings and lychee and coconut seedlings. The director of that MCC program listed several problems with the current system. His program operates out of Feni, and he has attempted to obtain seedlings from the Feni Horticultural Base Nursery, the Ramgarh Horticultural Nursery, and the Hathazari Regional Orchard and associated Horticultural Base Nursery.

He felt that the best quality control in producing grafted seedlings was at Hathazari, because they were using grafts from mother stock trees in their orchards. At the smaller Horticultural Base Nurseries, he noted that workers bought good-looking fruit from the local market and produced seedlings by direct seeding with no concern for provenance of the fruit. An additional problem was that these nurseries and orchards can not increase their production of seedlings and grafts to meet the demand of his program. He placed orders several months before the seedlings would be distributed and planted (at the beginning of the rainy season) and usually half or less of the order was filled. He suggested that with more staff working on propagation the Horticultural Base Nurseries could have increased their production of seedlings and grafts. He suggested, alternatively, that the Horticultural Regional Orchards could allow certified private nurserymen to go in and prepare grafts and airlayers from their orchard stock. Also, he was frustrated because the Horticultural orchards had much of their tree stock planted before Independence, and there were no sources of recently improved fruit grafting stock.

MCC's experience offers valuable lessons for the USAID agroforestry project. First, in an early stage of the project a team should rapidly evaluate varieties of fruit and timber trees and other relevant planting materials available for the project, both in Bangladesh and outside the country (e.g., improved mango varieties in India). In Bangladesh, this means looking at the government sources listed above and government research institutes (e.g., the Mango Research Institute, the Forest Research Institute, Bangladesh Agricultural University, etc.) and searching out private orchards for improved fruit tree varieties (e.g., Rajshahi mango orchards).

The next task for this central support team must be to set up a system for sufficient, timely flows of improved plant materials to the FSS staff. This will require identifying or establishing government or private seed and graft stock orchards. The timber, bamboo, cane, and leguminous cover crop materials could be handled by FRI and the Forestry Department system of seed orchards and nurseries. The fruit tree root stock and scion stock for grafting could be planted at the Horticultural regional and district orchards or at BARI regional stations. Eventually small scale private

orchards and nurseries can be started on land of interested farmers near the FSS.

In any case, it will be important for the trained agroforestry team at each FSS to spend some time going to the selected orchard sites to do direct seeding, branch rooting, and grafting to prepare nursery materials for their homestead trials. If seedlings are to be planted at the beginning of the rainy season (May-June), as seems to be necessary for many tree species, root stock seeds should be planted in the previous September or October and grafts done in the previous February. There will need to be a yearly schedule set up for propagation of various types of tree seedlings depending on type and method of propagation.

There are two benefits from the involvement of the FSS teams in seedling production. First, they will actually become expert at various propagation techniques and will understand quality control issues better. Second, they will provide more control over the production of the needed plant materials than if they rely entirely on Horticultural and Forestry nurseries. A failure to have timely, sufficient production of research planting materials will seriously undercut the project.

### Linkages

The agroforestry teams will need to be active in passing information of new technologies to a wider group of villagers. They will also need to be in contact with the agroforestry network of research and extension people.

Training and Demonstration Days - In addition to the above interactions with cooperating families, the FSS agroforestry team should arrange a series of training and demonstration days for various groups of villagers. These groups include the men in the villages adjacent to the FSS, interested women from these villages, villagers from multilocation testing sites associated with FSS, male and female Block Supervisors in the nearby upazilas, "model farmers" brought by Block Supervisors, and local NGO staff and their cooperating farmers. This suggests about 5-6 training and demonstration days should be scheduled each year when improved technology modules have been prepared.

This extensive undertaking requires the help of a central support staff as discussed below. Such activities require plant materials which can be used for demonstration and a room to be used for discussion and audio-visual presentations. Likely locations are BARI sub-stations or regional stations, Horticultural Base Nurseries, Community Forest Growth Nurseries, or Upazila Training Centers. Training would include such topics as alternative methods for propagation of specific trees and other plants, required growth conditions, management techniques, and alternative planting designs for homesite and field site areas. Some of the training should be based on slide-tape presentations and some must involve hands-on experience (e.g., grafting or preparation of potting soil for nursery materials). There should be group discussion time on each occasion for trainees to raise issues and give opinions. This feedback will almost certainly generate

future research ideas for the FSS staff. The project should include per diem travel compensation for participants and/or lunch. In addition, individuals interested in starting private nurseries should be provided with an opportunity for further training at one of the government orchards or nurseries.

Linkages with Government and NGO Research and Extension Units - The FSS agroforestry scientific officer must take initiative to keep in contact with nearby Community Forest Growth Centers, Horticultural Base Nurseries, BARI regional stations and substations, and the local upazila agricultural officer and Block Supervisors. In addition, the team should be in contact with any NGOs working locally with homestead production. Quarterly meetings may usefully be set up for information sharing among these groups. Also, the FSS agroforestry officer should maintain contact with any private persons in the local area that operate orchards or nurseries.

The central support group for FSS agroforestry teams should make certain that there are some in-service training sessions for them when new component training packages are available (e.g., from international or Bangladeshi research institutions). In this way pure researchers and the applied research FSS staff will be able to have regular dialogues and exchange of information about problems and developments in the homestead trials and new findings from research institutions. Also, the FSS team should have the opportunity to hear reports and have discussions with other FSS staff either at annual meetings or through peer team visits and review of each team's work.

#### Support for FSS staff

Central Support Staff - The extremely ambitious work plan for FSS agroforestry teams outlined above depends on an effective central support staff which frequently visits the FSS sites to provide backup services. These services include the following:

- Initiate and help organize linkages and exchanges among local FSS teams. Upazila agricultural extension staff, Forestry nursery staff, Horticultural base nursery team, BARI stations, and local NGO affiliates.
- Provide orientation to new staff members to maintain continuity in projects that will otherwise be disrupted by the expected high mobility of staff at FSSs.
- Aid local teams in analyzing local farming systems issues and designing suitable research trials.
- Set up a system that insures a timely and sufficient flow of the best available plant materials for the FSS agroforestry research.
- Monitor work of each FSS team every quarter and help with the annual evaluation and research plan.

- Prepare training and demonstration materials (e.g., audio-visual training packages) for Training and Demonstration Days and help the FSS team conduct these.

- Organize in-service training programs for the FSS staff.

Research Materials and Travel Support - The following materials need to be available to the FSS agroforestry teams so they can do an effective job:

- motorcycles for each FSS agroforestry scientific officer
- bicycles for male field assistants and per diem money for travel outside the local village area
- money for rickshaws for female field assistants and per diem money for travel outside the local village area
- 4 vans that the central support staff would make available for FSS teams in each of 4 regions for transporting plant materials and occasionally staff
- plant materials needed to set up demonstration orchards and research trials
- per diem expenses or lunches for participants in training and demonstration days
- office supplies for monitoring trials, keeping records, and writing reports and research plans.

### Training for the FSS Agroforestry Staff

#### General Training Schedule

There are several reasons for recruiting sufficient trainees to staff all twelve currently active FSS centers in the first training batch, and to initiate work in these centers as early as possible. One reason is to avoid increasing the already long delay that can be expected in contracting for a technical assistance team. If the technical assistance staff begins work in the summer of 1986, they should be able to schedule the first six month training program for scientific officers during December-May, 1986-87. The six week training course for the field assistants should be scheduled for May or June 1987. Then the teams can begin their first year tasks during August-September, 1987.

This means that the research trial designs, agreements with cooperating families, and planting materials should be ready for initiating research trials (planting) in April-June, 1988. Because of the nature of

research trials with trees, there will be a 1-5 year lag before results can be usefully evaluated and substantial benefits begin for villagers. If all twelve currently active FSS sites begin some trials in the first half of 1988, there will be some data and benefits available by mid-1990, with more in the following three years.

An alternative plan to speed up the benefits and the research would be to structure field exercises during the six month training of the scientific officers so that 4-6 FSS locations would receive intensive attention from trainee teams. The objective of these field exercises would be to do some rapid rural appraisal and agronomic analysis of village homesteads in order to prepare research designs and initiate research trials in these 4-6 areas one year earlier, in mid-1987.

### Training AFSOs

The trainees will consist of recruits with a B.Sc. or M.Sc. degree in agriculture. The general objective of this training is to produce professional staff capable of: 1) participating in dialogues with villagers to analyze household farming systems and identify needs and capacities with regard to fuel, fodder, fruit, timber, and craft materials and 2) designing, managing, and evaluating relevant research trials on homestead.

During the first three months of training the emphasis should be on classroom presentation of information, and discussions on such topics as:

- concepts relating to farming systems, village socio-economic issues, local markets, homestead production, multipurpose tree crops, and intercropping trees or leguminous cover crops with field crops.
- methods of research design, monitoring, and evaluation of homestead agroforestry trials.
- alternative indigenous and exotic tree species and varieties and other relevant plant materials (e.g., bamboo, cane, and leguminous fodder crops).
- growth requirements of the above plants and effects of varying environmental conditions (e.g., flooding, drought, soil variations, and shading).
- propagation techniques (with hands-on experience).
- management techniques including fertilizer and other soil amendments, watering, pruning, and protection (from animals, small pests, and diseases).
- harvesting techniques (e.g., multiple uses and multiple harvesting such as coppicing).

The last three months of the course should be focussed on the following:

- field trips or slide-tape presentations on relevant research in various Bangladesh institutions (e.g., FRI, BAU, and BARI).
- review (by means of field trips and slide-tape presentations) of possible solutions to homestead production problems and entrepreneurial activities in Bangladesh and other similar countries.
- field exercises selected to provide trainees with experience in having dialogues with villagers and problem-solving, using information presented earlier in the course.

These field exercise should be defined as trainee team projects with objectives of initiating research trials in 4-6 FSS locations.

#### Training Field Assistants

These trainees will consist of the 30-32 recruits with a tenth grade Secondary School Certificate (SSC), a twelfth grade Higher Secondary Certificate (HSC), or an AETI diploma. Recruitment for this batch of trainees should select people who live in the same general area where they will be working to facilitate rapid orientation of the team to the local situation. There are additional considerations for recruiting female field assistants which are discussed in section 4.1.4.

In general, selected portions of the training course for agroforestry scientific officers will also be used in training the field assistants. The field assistants should achieve some understanding of the general objectives of the project and the importance of dialogue with villagers in understanding local farming systems, needs, and capacities. They should also learn a repertoire of basic technical skills (e.g., propagation, nursery management, and harvest/mensuration techniques). In addition, they should have basic knowledge of tree species and varieties and other plant materials and basic biophysical requirements of each. Finally, they should learn a simple monitoring system for collecting and analyzing data.

HOMESTEAD AGROFORESTRY PRACTICES  
IN RURAL BANGLADESH\*

Kibriaul Khaleque

Introduction

This study was designed to collect information regarding on-farm forestry activities in rural areas of Bangladesh. Such information is intended to help the design team assess the economic feasibility of the USAID project entitled Homestead Agroforestry. The aim of this survey was therefore to gather data on:

- (a) homestead production activities;
- (b) the various species of tree cultivated on the homestead area;
- (c) cost of production and financial value of homestead crops produced;
- (d) price received for items sold on homestead;
- (e) gender roles in tree plantation and decision-making;
- (f) patterns of labour expenditure for fuel and fodder collection, and so on.

The Study Area

Seven areas representing a cross-section of agro-ecological zones, were selected for conducting this survey. These areas are: Dhaka, Barisal, Chittagong, Mymensingh, Rangpur, Pabna, and Sylhet. One village from each of these seven areas was then selected purposively. The selected villages are respectively Kalampur, Karnakathi, Mirjapur, Kazir Shimla, Janakinathpur, Kalikapur, and Ujaninagar. Out of these seven villages, two (Karnakathi in Barisal and Unaninagar in Sylhet) belong to the villages adjacent to proposed Farming System Sites, while the other five are from those adjacent to existing Farming System Sites in those areas.

Selection of Households

Thirty households from each of these seven areas have been selected purposively. Thus 210 households were selected out of a total number of 1790 households in these seven areas (Kalampur - 300, Karnakathi - 325, Mirjapur - 300, Kazir Shimla - 215, Janakinathpur - 275, Kalikapur - 200, Unaninagar - 175). In other words, 11.7 percent of the total households were covered in this survey. Before selecting the households local leaders or other knowledgeable persons, e.g. Union Parishad members or chairman, were contacted and an estimate was gathered from them of the total number

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\* A complete version of this report including Tables, is available in the project files.

of households in the village as well as the number of households belonging to different socio-economic and land-holding groups. Then, the households for survey were selected in such a manner that all socio-economic groups are represented in the survey.

### Respondents

For gathering information at the household level the household heads were interviewed, but in cases where the head was unavailable, any other reliable member was interviewed. In most cases male members were selected as respondents, but in some cases female members were interviewed.

### Interviewing

Respondents were interviewed by field investigators according to a pre-formulated interview schedule. The survey supervisor also carried out informal interviewing with local leaders knowledgeable about homestead production activities.

## Socio-Economic Condition and Demographic Characteristics

### Age of Respondents

The age of the respondents of this study ranges from 20 to 80 years. The mean age is 43 years.

### Educational Background

The majority of respondents are either illiterate (34.3 percent) or their educational attainment is only up to primary level (41.5 percent). However, some of others (2.4 percent) having higher secondary education or above (0.9 percent).

### Occupation

Out of the total of 210, the members of 160 households (76.2 percent) depend for their livelihood exclusively on agriculture and those of 40 households (19 percent) on both agriculture and some non-farm activities, while the rest (4.8 percent) live on non-farm activities. Of the 200 households which depend on agriculture entirely or partially, the household members cultivate their own land in 52 percent of cases, sharecrop in 9.5 percent of cases, are engaged in both cultivating own land and sharecropping in 32.5 percent of cases and work as agricultural laborers in 6 percent cases.

### Family Size

The number of members living in households studied varies from 2 and 20 and on average 8 persons live in a family.

### Land-holding Size (Arable Land)

Except for 22 households (10.5 percent) out of 210, all others have some cultivable land ranging from 0.10 to 16 acres. The median holding size of arable land is 1.16 acres.

### Homestead Size

Only four (1.9 percent) households out of 210 do not have their own homestead land; homestead land areas varies from 0.05 to 3.50 acres. The members of the four households having no homestead land were found living on homestead land of less than 0.10 acre provided to them by patron households as a temporary grant for service. The median homestead size is 0.24 acre.

### Homestead Forestry

#### Existing Tree, Bamboo, and Shrub on Homestead

The most common species of existing trees, bamboos and shrubs on homesteads in the study areas are:

Tree (timber): rendi, koroi, gab, chambal, tetul, neem, mehagani,  
segun

Tree (fruit) : mango, jackfruit, jam, coconut, betel nut, guava,  
palm, amra, bel, boroi, lychi, jambura;

Tree (fuel) : shimul, mander, badam, kadam, babla, kapula, bot,  
jarul, jiga, sheora;

Bamboo : bara, talla, nali (muli), bashni, makla;

Shrub : hijal, hatali, chankata, bhenna, bohoi, Moinakata,  
fankata, dumur;

Generally, people in the study areas have a combination of one or more of the above mentioned fruit, fuel, and timber trees on their homesteads. The inquiry that some species are more common than others.

The respondents can seldom give the exact age of trees they have on their homesteads. It is, in fact, difficult for most of the illiterate rural people of Bangladesh to remember their own age, and perhaps more difficult to remember the age of their trees. However, rough estimates of the age of existing trees varied from 2 to 40 years.

Besides trees, bamboos and shrubs, almost every household grows some vegetables on the homestead. The most common vegetables grown on homesteads are: pumpkin, local gourd (lau), bean, potato, radish, egg-plant, tomato, pui, palang. Some households grow, in addition to vegetables, such other crops as oil seeds (mustard, linseed), and pulses (lentils, mung, khesari).

### Tree Plantation

Out of the 210 households, no trees were planted in 62 households (29.5 percent) during the last five years, while some trees were planted in the other 148 households (70.5 percent). The number of trees planted by these 148 households ranges between 2 and 200, and on average 18.2 trees were planted. Most households planted the common local timber and fruit trees, but 28 households (18.9 percent) planted such non-local timber trees as mehagani, segun, and sal.

The majority of households (68.6 percent) have room for planting 2 to 200, additional trees and on average each household would have room for planting 35.2 trees. All households having room for planting new trees reported that they would like to plant as many trees as they have room for on their homestead. In 72.5 percent of cases, people said that they would like to plant common local trees, but in the remaining 27.5 percent of cases they mentioned the names of such non-local species like mehagani, segun, sal, ipil ipil, and so on.

It was observed that, in most cases, (74.3 percent) trees are planted by both male and female members of the households, in 20 percent of cases this task is performed by male members only, while in the remaining 5.7 percent of cases, by female members only. It was learnt that male members generally plant timber, fuel and fruit trees on homestead plots located far-off from the living houses, while the females plant fruit trees such as ata, boroi, guava, dalim, and so on, close to the living houses. Except for these fruit trees, the decision on what tree should be planted where on the homestead is generally made by male members. Watching and taking care of the newly planted trees is considered the responsibility of all family members, and accordingly everyone -- male and female, adult and minor -- performs these tasks. However, male members usually look after trees planted on the plots far-off from the living houses, while the females do this for the trees near the living houses.

Vegetables and other crops on the homestead are planted by females when these are grown on a small scale for household consumption, but by males when these are grown for market on a large scale. Thus the decision on what kind of vegetables or crops to be planted where on the homestead and also on who will plant what depends mainly on the nature of production.

### Raising Trees

Most respondents reported that, in order to make a newly planted tree survive and grow, they usually take a combination of special measures such as putting up fences, guarding, using cow-dung or compost, watering, weeding, and so on. It was reported by respondents in 78 households (37.1 percent) that raising trees is not difficult, but those in the other 132 households (62.9 percent) consider this a difficult job. In support of their statement, the latter gave such reasons as shortage of fencing materials or money for purchasing them, frequent damage caused by cattle or goats, theft of seedlings by enemies or social rivals, and so on.

### Sources of Seed/Seedling

The people reported that when they plant trees they generally get seed/seedlings from trees they already have on their homesteads, or they collect these from relatives or other villagers. However, most of them also purchase seed/seedlings from local markets or government nurseries. It was reported by 125 respondents (59.5 percent) that they know there is a government nursery in their locality (within a distance ranging between half-a-mile to five miles), while the rest 85 (40.5 percent) do not know this. Among the 125 respondents who have knowledge about the existence of a government nursery, 83 (66.4 percent) purchased seed/seedlings from that nursery, but the other 42 (33.6 percent) did not. For not purchasing seed/seedling from government nursery, the respondents gave such reasons such as (a) they did not need to purchase seed/seedlings; (b) they get better quality seed/seedlings from the local market; (c) it is difficult to carry seed/seedlings from the far-off nursery, whereas it is easier to do so from the nearest market, and so on.

### Sale and Purchase of Trees and Bamboos

Generally, people in the study areas sell whole trees and bamboos (unprocessed) from their homestead. The price of a whole tree or bamboo is determined by age and species (and quantity in case of bamboos). Slight variations in price of the same species may be found from one area to another, largely due to the availability and non-availability of that species in different areas. Purchasers usually saw and chop timber or fuel on the spot where a tree is sold (on the homestead of the seller). The amount of labour required for chopping, sawing, and transporting the produce to the purchaser's house or to the market varies from 2 to 45 mandays.

### Fuel Collection

The people use one item, or a combination, such as cow-dung, rice-straw, rice husks, bamboo residues, fuelwood, tree leaves, jute residue, and so on, as fuels for cooking. They generally collect these fuels from within their homestead area or agricultural fields (both owned and that of others). The distance from the living house to places where they collect fuels ranges from 100 to 1000 yards in cases where they collect these from the homestead, and between one and four miles in cases when they collect these from agricultural fields. Fuel for household consumption is collected by both male and female members in 113 households (53.8 percent), but exclusively by male members in 20 households (9.5 percent) and exclusively by female members in 67 households (31.9 percent), while servants collect it in 10 households (4.8 percent). In households where both male and female members collect fuels, males generally bring rice-straw or other crop residues from the field, while females collect leaves and twigs from the homestead garden and cow-dung from the cow-shed. The average time spent per week by family members (or servants) for collecting fuels is 13.8 hours.

In response to a question on what alternate uses fuels have, most people said that they could have used rice-straw as fodder or for construction roofs for their thatched houses, cow-dung as fertilizer, leaves for making compost, twigs and tree branches for fencing, and so on.

#### Fodder Collection

Grass, rice-straw, rice-bran, other crop residues, leaves (mainly bamboo leaves), and oil-cake, are the most common fodders in the study areas. People in these areas generally collect grass from their homesteads, fields, field-boundaries, marginal land, and sides of public roads. Out of 210 households, male members collect fodder in 46.2 percent of cases, female members in 13.3 percent of cases and both male and female members in 29.1 percent of households, while in 9.1 percent households this task is performed by servants. The distance to places where people collect fodder ranges from 100 yards to three miles from the living house, and average time spent by family members (or servants) is 17.6 hours per week.

In response to a question regarding alternate uses that fodders have, it was reported by most respondents that they use rice-straw for constructing roofs and walls of their thatched house, or burn them as fuel.

#### Knowledge about Government Agricultural Services

Out of 210 respondents, 119 (56.7 percent) know about a block supervisor, whom they usually call Krishi Officer (Agricultural Officer), while the other 91 (43.3 percent) do not know. Of 119 respondents who know about the Krishi Officer, 73 (61.3 percent) said that they had met him, but the other 46 (38.7 percent) had not. It was reported by 47.9 percent of the respondents who had met the Krishi Officer that he came to their village, and 23.3 percent said that he came to the local market where they met him, while 28.8 percent said that they went to his office. It was reported by 69.9 percent of the respondents who had met the Krishi Officer that they received some services (mainly advice on farming, but in some cases agricultural loans, seeds, fertilizer, insecticides, and so on) while the other 30.1 percent said that they had not received any service.

SOME OBSERVATIONS ON  
HOMESTEAD AGROFORESTRY IN GOLLA  
VILLAGE, DHAKA DISTRICT

Michael M. Calavan

I was in the village for about 45 hours. During that time I spent about 10-12 hours actually talking to people. (About normal for "rapid rural appraisal" — five hours per day of interviews is a good average.) Most of my questions were of a basic, simple-minded type. What's that? What are you doing with it? Where did you get it? (The skill comes in asking intelligent, insightful followup questions).

The information that follows is scattershot. It's useful, I think, because it indicates the sort of information that Agroforesters at Farming System Sites will need to gather and assimilate before they can select cooperating families and initiate homestead trials.

These short visits make me moderately optimistic about the project. In many families there are individuals — young and old, male and female — who take a strong interest in homestead production. I believe they will be particularly responsive to innovations which promise increased household income, or increased, sustained household fuel supplies.

The following observations indicate the "flavor", if not the actual structure and detailed strategies, of homestead production activities.

The importance of formal control over land - A Christian family, surrounded by Hindus, controls 1/3 acre of house land. Many trees, shrubs, plants have been planted over the past 15 years. However, they bought the land without formal deed, and are not planning to sell it. Since only about one-third of the value of the land can be recovered (without a deed) family members have stopped planting new items and are even deliberately "running down" the biological stock e.g. two mango trees that were in their "bearing prime" were recently sold for about Tk. 500 each.

Coconuts - Coconut trees are a productive homestead crop, but are slow to come into production, and require someone willing to climb a very tall tree to harvest the crop. Most families don't have anyone brave or foolhardy enough climb and pick. Pickers take half of the nuts harvested. It takes 10-15 years for a coconut tree to bear its first fruit. One Golla family got 60-70 nuts (after sharing with a picker) from each tree. Total cash value from three trees was about Tk. 600-800.

Water resistance - Houses are located on raised mounds 6-10 feet above the level of tanks in the dry season. Large areas of the village residential area are flooded for two to three months of the year. Villagers know which species are resistant to drowning, and plant them in low areas. Some water resistant species include:

aurjaun - A tree good for firewood production.

Mulberry - Produces a fruit.

Tamarind - Produces a fruit used in flavoring sour dishes.

baujna - Trunk can be sold for firewood production.  
Branches can be coppiced for firewood.

Kul - Has a small fruit similar in appearance to the olive  
Timber from its trunk is used in making furniture.

pishpaul - Has a fruit like a small lychee.

Firewood - Some people with sparse homesteads, do buy pre-cut firewood from their neighbors. The current price is Tk. 30-50/maund, depending on dryness and quality. The price has not increased greatly in the last couple of years, but is 2-3 times more expensive than it was 5-6 years ago. There is no organized trade in small lots of firewood for family use. People buy cut firewood or whole trees from their neighbors.

- o On male and female roles in homestead production - Individuals of either sex may take a strong interest in homestead production. In most cases, both sexes can plant, cultivate, and harvest. Since many items are sold at the homestead, both women and men can sell homestead produce. There are some things that women don't usually do, and for which they require the assistance of family or hired males. Women break and cut small branches for firewood, but don't ordinarily cut down large trees or split firewood or cut planks from the trunk section. No women (and relatively few men) are willing to climb full-grown coconut trees. In most cases, outside workers must be hired.
- o Most families preserve a smooth, plant-free drying/threshing floor near the house. This area is essential for processing crops, drying firewood, etc. The size of the area varies from about 10' x 20' to about 30' x 50'.

Land values at Golla -

- Planted homestead land with clear deed and houses = Tk. 100,000 - 200,000/bigha (1/3 acre).
- Low paddy land = Tk. 35,000-40,000/bigha.
- High paddy land = Tk. 50,000-60,000/bigha.

(House land without a deed is worth one-half to two-thirds less).

Bamboo - Four types of bamboo are cultivated in Golla, each with a different set of uses:

- 1) \_\_\_\_\_ bash (didn't get name) - The wall of the stem is thin. The nodes are far apart. This is the preferred type for making bamboo wall panels.
- 2) ura bash is Bambusa vulgaris, I think. The wall is somewhat thicker (than #1) and the nodes are closer together. It's a general purpose bamboo for use around the house. It's used for fences, baskets, etc. It's used, in combination with the species above, as the edging for bamboo wall panels.
- 3) jaoa bash - This species has a somewhat thicker wall. It is fairly strong. It is used for poles and fences. Sliced in small strips, it can be used for the "sweep" portion of brooms. Is also used in making baskets.
- 4) baura bash - This variety has a large diameter and thick walls. The diameter may exceed 6". It is very strong, and resistant to dampness. It is used for making large, stationary dip net on Bangladeshi rivers. It serves well as house poles in construction of traditional houses.

One resident of Golla sells about Tk. 1000 worth of bamboo each year. He sells varieties 2, 3 and 4 above. Prices range from Tk. 22 to Tk. 35 per pole. Another informant reported that a large baura bash pole — 6 or 8" in diameter, and 35-40' long — retails for Tk. 80-90).

Near the launch stop there is an open air bamboo shop. Customers can buy bamboo poles, or order panels for house construction. In addition to the four species listed above, the shop sells a fifth species: Tolla bash is very straight and thin, and may be imported from Mymensingh or Sylhet.

Edible items - In one homestead I found the following edible items. 1) A lemon tree, that stopped bearing two years ago. 2) Two kinds of chillies. 3) Sweet basil, which is used in Bangladesh largely as a medicine. 4) Turmeric. 5) Aram - A plant that looks like the decorative "elephant ear". Stems, leaves, and roots are edible. 6) dandoil - A bitter vegetable that looks like a cucumber with spikes. It grows on a bamboo frame about 7' high. 7) Two species of bananas, kobri kaula and bita kaula. The latter has "too many seeds", and isn't eaten much by the family. 8) Custard apple - 3 trees. 9) Areca palm - the areca nut is eaten with betel leaf. 10) One jute plant is raised to produce seeds, and as a source of food. Young leaves can be cooked in a curry and older, dry leaves provide a bitter flavoring for several dishes.

Beauty - A number of species are cultivated because they provide nice flowers and pleasant scents. Flowers included: jasmine, marigolds, Easter Lilly, Hibiscus, and a "yellow flowering tree".

Malacca cane - The major local use for cane is in broom manufacture. One type of broom has a "sweep" made from the outer portion of the cane. All brooms (made locally) are bound at the top with cane strips. Cane grows,

with little attention, in very low areas of the village. Canes are cut every 2-3 years, when the stems are 15-20" high and 1" in diameter. The buyer pays 50 paisa per stem, and after cleaning and trimming, sells them for Tk. 3-4 each. One area about 15' x 20' produced only 20-25 salable canes in a two year period.

Salable items -

- . Cane
- . Coconut
- . Bananas
- . Mango trees - The trunk for timber and the branches for firewood.
- . daebdaro - Another source of timber and firewood.
- . khaudom - A tree with a long straight trunk that can be used in producing matchsticks. Factory agents come to the village.
- . eejaul - The branches are sold to fishermen, who use them in fish traps.

Fish traps - bamboo "fences" can be seen in the water near the banks of many rivers. eejaul branches are stripped and piled inside the bamboo barrier, where they provide a sanctuary for fish. Twice each year a net is placed around the bamboo fence, and then all of the branches are removed. Fish inside the barrier are caught with dip nets or throw nets. The branches are good for 3-4 years. One Golla resident recently sold 20 eejaul branches for Tk. 250.

Water hyacinth - These plants grow in many village tanks. Anyone can collect hyacinths from a tank at no cost. Fresh, they provide an inferior feed for cattle. They can be composted with mud, and after 3-4 months used to fertilize gardens, paddy fields, etc.

Imported timber - Workmen were cutting planks for window frames for a village house. The planks were being sawed from rough cut timber about 8" x 8". The timber is from the sundaori tree, a major species in the Sundarbans. The timber is brought by boat from the Sundarbans to Bandura, the next river stop, and a substantial trading center. The timber is purchased at Tk. 300 for "one cube" or cubic foot. The workmen earn Tk. 50/day, and take 3-4 months to build a complete house.

Manure - Some village families dry cattle manure as a source of cooking fuel. I saw this in only one homestead, but it was reported that other families -- Hindu, Christian, and Moslem -- follow this practice.

Rice processing - Rice is hand pounded, largely by women. Before hand pounding, it is parboiled. A variety of fuels, including paddy straw,

wood, and rice husks are used. Rice straw is gleaned from the fields during the November-May period. The family which requires its rice to be husked gives the "processor" 1 1/2 maunds of paddy, and gets back 1 maund (40 seers) of hand pounded rice. The processor gets: rice husks, bran, broken rice, 2-3 seers of whole rice, and about Tk. 5. The processor provides the fuel.

Pottery making - Pottery kilns require a lot of fuel. The one I saw was quite large. The lower portion is a large "oven", about 20' in diameter and 2-3 feet high. The oven top is a large platform, on which pots are carefully stacked, then surrounded by straw and mud. I was told that the kiln is fired once a month for 24 hours. The kiln (cooling when I saw it) was said to contain 300 pots worth about Tk. 1000. Given other information I received on fuel requirements, this level of production seems "uneconomic". During the year, a variety of fuels are used -- coconut trees, jute sticks, date fiber, wood, bamboo branches, etc. During the rains, when the water is high, big boats come from the south with firewood. Relatively large amounts are purchased and stacked to fire the kiln. The cost is Tk. 30-50/maund. The potter told me that it takes about Tk. 500 worth of purchased wood (10-15 maunds) to fire the kiln for 24 hours. When this source runs out, the children of the family spend a lot of time collecting fuel.

Broom making - A Hindu broom maker makes three types of brooms, and appears to "clear" about Tk. 1500-2000/month. Most of his materials are purchased from local families (canes, bamboos, coconut fiber) or from dealers who offer the same products at a weekly hat at Jaypara, a nearby village. There are middlemen dealing in all of these products -- cane, coconut fiber, and bamboo. The cheapest broom he makes requires Tk. 3 worth of materials, and sells for Tk. 5. He can make 200-300 such brooms per week.

Mattress makers - Itinerant male workers move from house to house, making mattresses, pillows, and other items from materials provided by the customer. They carry "cards" (for combing cotton or kapok) on their shoulders. I believe that some village families raise kapok trees, but wasn't able to confirm this, as there was some confusion between the English words "cotton" and "kapok". The Bengali word I learned was tula.

The village of Chotogolla ("little Golla") holds common land of several acres. It contains a market, soccer field, etc. Cattle graze there. There might be room for some tree growing trials.

Closing comments:

- These notes provide a rough introduction to homestead production activities (and related marketing and craft activities) in one village. Other areas will vary widely from this norm. But it does suggest the sort of things that Agroforesters at FSS will need to know. They can learn much of what they need in a few weeks of concentrated work, if they master the techniques of "rapid appraisal"

and "semi-structured interviewing" during their training. One or two field trips in which they are required to talk to and learn from rural residents will help a lot.

- Introduction of exotic bamboos with specific, known uses will be of great interest to villagers at Golla and elsewhere.
- Based on the Golla visit, production of cane on or near homestead land (the subject of one research project at FRI) doesn't seem a very exciting prospect. Further modest investigation should be made before any field trials with cane are introduced.
- Several people verbalized a concern and strategy for "sustained fuelwood production." Traditional species are already being used for this purpose, and I believe that Golla residents would be greatly interested in trials of exotics -- eucalypts, acacia, etc.
- Potters should be particularly interested in assistance with a trial of "intensive, sustained fuelwood production".
- Fodder supplies didn't seem to be a particular concern at Golla. However, a few days more of Rapid Appraisal might show that this is wrong.

## INSTITUTIONAL ANALYSIS

Catherine Lovell

### General Recommendations

The household forestry project emerges as having three main components: 1) Research, 2) Education of Educators or Training of Trainers, and 3) Dissemination - Outreach Activities which link existing knowledge and new research to farm households. The components, with brief outlines of sub-components are listed below. The lists of sub-components are intended to be indicative of institutions and activities to be funded rather than exhaustive.

#### A. Research on Agro-Forestry

Forest Research Institute and its Silviculture Stations

Farming Systems Research at BARI, BRR1, BJRI, other Research Institute Sites and at one NGO Farming System Site.

Research projects at Universities, Research Centers, Horticultural and other nurseries, etc. funded by mini-grants.

#### B. Education of Educators and Training of Trainers

Education both short and longer term for

BAU Professors

AETI Teachers

Forestry Teachers (Institute of Forestry Chittagong, Forest College)

Technical Officers of Department of Agriculture Extension — Subject Matter Specialists; Subject Matter Officers; Upazila Agriculture Officers; etc.

Research Institute Farming System Site Research Officers

Training Institute Personnel

Graduate Training Institute, BAU; Bogra and Comilla Academies; CERDI; IPSA; BARI; BJRI Training Components; Central DAE training offercers, etc.

C. Dissemination - Extension Linkages

Training for those directly linked to homesteads  
DAE Block Supervisors both male and female  
Union Councils — particularly female members  
BRDB Upazila Level Organizers and Trainers in  
Upazila Training Centers  
NGO field personnel who have direct contract with  
farm families  
Nursery Employees — Govt. and Private

Training of Farmers and Female Householders

Field days at Farming System Sites, Nurseries,  
Silviculture Sites  
Special short-term training sessions at local  
centers, or through mobile training teams in  
villages.

Dissemination of Quality Controlled Planting Materials  
Nurseries both Public and Private  
Hats, Bazars, Other outlets

Section II of this paper discusses the contemplated organizational and management arrangements and their administrative feasibility for implementing the components as outlined above. Subsequent sections review in further detail the principle possibilities, constraints, and issues connected with the execution of each component.

The following are general recommendations for consideration in the final project design:

1. Fundamental to the project is institutional capacity building and sustainability of agro-forestry motivation and capabilities.

Even a short survey has revealed that a number of other donor projects undertaken during the last decade have emphasized homestead planting, yet almost no institutional capacity has been developed to mount sustained efforts. The need for sustained effort provides the rationale for the project's focus on institutionalizing government agro-forestry research capabilities and for incorporating trained personnel and curricula into the on-going agricultural and forestry training institutions and extension activities. Emphasis is given to training of trainers who will be embedded in the regular institutions as teachers, or researchers, and into the agricultural research and extension institutions as subject matter specialists and officers, agricultural officers, trainers, etc. The focus is on adding to the knowledge and motivation of existing personnel with regular career patterns rather than on the infusion of new and perhaps peripheral personnel.

The importance of sustainability has pointed to the focus of agro-forestry concerns in the mainstream of agriculture research and extension rather than solely in the forestry department. The Agriculture Extension program is clearly in direct touch with farmers and extension-farmer linkages are expected to become stronger. The Forest Department linkages with farmers are weak and the traditions, ethics, training and career paths of forestry officers emphasize and reward forest conservation and commercial forestry rather than linkages with individual households. The government has apparently taken the view that agro-forestry is to become the concern of agriculture rather than forestry at this stage.

The importance of sustainability also undergirds the incremental nature of the proposed project activities. The components emphasize small changes that are achievable and do not posit major institutional changes or massive outputs. Small successes will aid institutionalization, because success breeds success. Small, incremental changes can be absorbed into existing institutions with a minimum of disruption and can build on existing competencies in institutions and personnel.

The project is designed to increase the skills and motivation of indigenous individuals and organizations. Expatriate experts and trainers are employed only as necessary in the early stages.

2. The nature of the projects multi-institutional components as well as the changeability of the Bangladesh political and institutional environment suggest a need to provide exceptional flexibility in project design and budgetary planning. Bangladesh is a large and complex country with an unusually large donor community and an increasingly complex institutional framework. The institutional environment is volatile, the project must be able to take advantage of opportunities as they arise and to close out activities that are unsuccessful. Coordination among related projects occurs primarily through self coordination in the course of project implementation so flexibility to make adaptations as necessary is essential.

Another reason that flexibility is essential is that circumstances are very different in different parts of the country -- soils, economic bases, farming system patterns, water availability and flooding, receptivity to new ideas, experience, etc. varies widely. As research takes place and experience in research and outreach is gained in various parts of the country, opportunities and constraints will be revealed. Flexibility to respond to opportunities must be available.

3. The design of the project accepts the efficacy of redundancy -- multiple avenues of research, education and outreach are intentionally designed into the project. Agro-forestry is a new field, household forestry is a very new aspect of agro-forestry. Little experience exists on which proven methods of research, training and outreach can be based, consequently, multiple tracks which can provide such experience are valuable. The institutional framework in Bangladesh is somewhat fragile and is constantly buffeted by demands that change organizational directions, reorganize activities, constrain actions, open new possibilities or close channels. Redundancy provides a fail-safe mechanism so that if one avenue is closed or ineffective, results can be achieved by other methods. Also, different organizational channels may reach different clienteles, for example, one channel may reach primarily larger farm households, or only some areas, others may reach the smallest households and only some areas. Some training may reach the younger, newer agricultural officials, other avenues reach the older and more experienced personnel. Effective accomplishment and reduced danger of implementation failures require the uses of multiple channels.

4. Self-coordination and mutual strengthening mechanisms among the researchers and trainers in agro-forestry are also recommended. Since agro-forestry is a new field, crossing forestry and agriculture, a professional ethos is not developed and professional interchange structures do not exist. Activities such as workshops, information exchanges, report sessions, professional meetings, etc. will be important to undergird a sense of mission and to provide continuous encouragement to the newly trained individuals and researchers. Money must be earmarked for this purpose.

5. Because of the multi-component and multi-institutional nature of the project, and because of the lack of experience worldwide in household forestry activities, and because of the problems that many projects in Bangladesh have had in timely and effective implementation, a process-documentation system as a continuous monitoring and evaluation function is recommended. Money should be earmarked for this purpose. Section VIII provides more details on this recommendation.

6. In the operation of the project it must be recognized that the structure of implementation is non hierarchical. Since multiple organizational structures are involved in implementation and there is no clear hierarchical relationship among the implementing organizations, project managers will be required to utilize management methods that emphasize motivation, information sharing, incentives and internalization of project goals. Ways must be found to provide the mechanisms for exchange of research results, feedback to everyone on progress, continuous exchange of information, and self coordination. Success must be shared and

positive results at the homested level used to inspire continued dedication and cooperative actions. Command administration will not be appropriate.

### Significant Issues in Personnel

There are four issues in the personnel area which must be considered in the design of the project. They are 1) recruitment rules and delays, 2) seniority, promotion and transfers, 3) training rules, particularly for overseas education or training, and 4) the use of expatriates.

Recruitment Rules and Possible Delays - Recruitment and selection of new employees is done differently in the "pure" government service such as DAE and in the semi-autonomous bodies (which include FRI, BARC, the various Research Institutes and BAU). In general, recruiting for the pure government service is handled by the Public Service Commission. For the semi-autonomous institutes recruiting is done by the institutes after obtaining permission from the Ministry of Establishment and PSC.

Examinations are held annually (sometimes less often) for the cadred services (Class I officers). For non-cadred employees and for those in the semi-autonomous institutes (including Class I non-encadred) employees can be recruited any time vacancies occur as long as the proper clearances are obtained. In those cases the substantive ministry and the Public Service Commission must approve, then the positions must be advertised and applicants are screened and interviewed. The process takes from three to six months minimum.

In cases where positions do not now exist in pure government organizations the creation of a new position must be approved by the substantive ministry, then the Ministry of Establishment and the Ministry of Finance before recruitment can be considered. This process takes a minimum of six months and usually longer. For the semi-autonomous institutes new positions can be created if there is sufficient budget to cover the costs and recruitment rules followed. The issue for this project is to be aware of potential delays and problems in creating new positions. It would obviously be better from several standpoints to attempt to provide training and an emphasis on agro-forestry for existing employees in order to avoid both delays in recruiting or creation of new positions. Also, to the extent that present employees can be utilized the necessity of increasing budgets is obviated.

Seniority, Promotion and Transfers - Employees in both pure government positions and in semi-autonomous institutions are eligible for promotion based on seniority and merit. Merit is determined by the evaluations of superiors which are written annually. (These are called the Annual Confidential Reports). Transfers take place both as a result of promotions

and as a result of the government's transfer rule which requires transfer at least every three years. In large, pure government agencies like DAE promotions and transfers may be made among all parts of the organization providing the person is eligible. In the semi-autonomous organizations promotions and transfers will take place only within the institution. (The exception to the above is FRI where, since the FRI is part of the Forestry Division, encadred forestry officers hold the top positions. In that case those officers may be transferred anywhere within the Forestry Division).

Promotions in rank are possible only if there are open positions available. Promotions in grade take place within ranks primarily based on seniority. Transfers are often made within ranks and transfers are desired primarily for salary raises, location or work interest. Transfers are sometimes accepted reluctantly primarily for locational reasons.

The issue for this project is primarily the transfer problem. In the semi-autonomous institutions the transfer problem is not so serious because a person trained in agro-forestry is likely to transfer only within the institution and the expertise will be valuable wherever he or she goes. In the pure government organizations like DAE the problem may be more serious as there is a good deal of transfer among various cells and units. Among the SMSs, SMOs and UAOs the problem is probably not serious because the training will be useful wherever the person is assigned. For those persons trained in agro-forestry in the central cell or in training functions, transfers might result in placement where little use can be made of the training. It would seem important, therefore, to recognize that more persons will need to be trained than might seem essential were the transfer problem not considered.

Overseas Training Rules - The government has specific and rather stringent rules on eligibility for out of country training for government employees. (See Annex IX for outline of key rules). Persons over 35 may not be sent out to study for Masters or Ph.D. degrees. There is no age bar for workshops, short term training, or non-degree training.

For medium-term courses and higher study, restrictions based on educational qualifications have also been imposed. Medium-term course candidates must have a minimum of one second division and for Master or Ph.D. courses candidates must have two first divisions and no third divisions in their academic careers. No restrictions have been placed on study tours, seminars, short courses or post-doctoral programmes.

Persons sent for higher education must agree to pay back the country with five years of service or give up the posted bond of Tk.50-100 thousand. Permission from the Secretary of the relevant ministry is always required for outside trips.

The government also has prescribed a detailed process for selection of candidates for overseas study which requires procedures and approvals from the concerned ministry as well as from the Ministry of Establishment Foreign Training Section, ERD and Director General of Immigration. The process can take from one month to four months.

The issues for the project include selection, timing and qualifications. Persons selected for degree programs must meet the age and educational qualifications criteria regardless of present position, interest or experience. Sufficient lead time for selection and processing is essential.

Expatriates - Although the government recognizes the need, under certain circumstances, for expatriate consultants or specialists, its general stance is to attempt to minimize their use. There are several reasons for this position, 1) expatriates are very expensive, 2) the intention is to bring Bangladeshis up to expert levels as soon as possible, 3) in many cases Bangladeshi experts who exist in the country have been overlooked, and 4) more subtle reasons of morale. On the last point it is difficult for Bangladeshis to work side by side with expatriates who are making many times the salary and living at standards far beyond those that could ever be attained by even top government employees. This disparity is recognized as one source of corruption. Also, often the Bangladeshi may not have formal training but may have a great deal of experience and local knowledge which is not recognized by the external expert.

Finally, since capacity building is the intent in the homestead forestry project, expatriates must be prepared to recognize their role as that of consultant, coach and mobilizer of resources rather than "expert", "substitute" or "manager". The terms of reference of the expatriates to be financed by this project should include clear specifications in these terms about the kinds of roles the expatriates will be expected to play.

#### Procedures for Funding Research

The procedure for funding research through BARC currently follows a rather set pattern including solicitation of proposals, review, selection, and release of funds.

Proposals are solicited through national newspaper advertisements and announcements sent to research institutions and universities. Proposals must be submitted in a prescribed proforma. The proposals are reviewed by the related divisions of BARC and copies are sent to reviewer/experts for opinion and comment. Together with the comments/opinions of the divisions and outside reviewers the proposals are then reviewed by the BARC Technical Committee which is composed of experts from BARC, Foreign Consultants, and outside experts. The Technical Committee is the final approving body.

After a proposal is approved it goes to the Finance Committee which must allocate and release the funds. Funds are normally released quarterly. When the allotment for one quarter is exhausted an allotment for second quarter will be made provided the researcher has submitted financial statements for the completed quarter showing details of

expenditures and a technical statement showing the corresponding status of the study. Funds will not be released for subsequent quarters until these reports are accepted. The reports must be prepared according to proformas required by BARC and often include requirements by the outside donor if one is involved.

BARC normally encourages research projects with maximum durations of 3 to 5 years. Progress on the research is reviewed/evaluated every six months or annually by BARC experts or hired evaluators.

The above described normal procedure will in several respects not fit some of the research contemplated under this project. The above procedure assumes a research institute or university with researchers and support services in place. The household agro-forestry project is designed to enhance agro-forestry research capability at FRI and BAU, and to integrate agro-forestry research into the on-going farming system site research. These institutions have little existing agro-forestry research capability in place. As a result, some of the research money will initially be required to establish capacity and to develop designs for useful research. The present system of grants assumes a researcher in place with time and institutional support to prepare a research proposal that can survive a rigorous review process. That capabilities not yet in place in agro-forestry.

Examination of this issue suggests that ways must be found to assist the research institutions in planning and developing research projects. One possibility is that for the first two or three years capacity building grants might be made available on an annual basis which would be used by the institutions to improve their capability and generate competitive research designs. A competitive research design would assume that preliminary research has been conducted to assist in generating the proposal.

Another possibility might be to pass through money in designated lump sums to the three main participating research institutions, BAU, FRI and BARI (for the Farming System Site research). Within these institutions an internal refereeing process could be set up to screen research proposals. Monitoring and evaluation by BARC might then take place each six months or annually to assure that the money is being used wisely.

A second problem with the current process is the delays that accompany the grant process. The whole process from initial call for proposals to final allocation of money may take as much as six months or more. Once funds are released to the government for the agro-forestry project there will be delays in getting the project started. If additional delays of six months to a year are added to the process it will be a long time before research can begin and even longer before benefits can be felt at the homestead level.

A third problem with the current process is the quarterly release of funds and the release being contingent on the acceptance of reports. This process which sometimes delays fund release would be particularly inappropriate for farming system site or other field research where support costs (such as field laborers, transport, research assistants, etc.) must be continuous or the research is unproductively interrupted. If there are delays in the quarterly fund releases with resultant halts in research, waste and inefficiencies will occur.

Another kind of grant which might not lend itself to the established process would be support for thesis projects. It is contemplated that some research grants might be allocated for research projects relevant to agro-forestry at BAU or other universities.

These problems should be discussed with BARC and alternative funding patterns developed, along the lines described above.

Finally, some of the mini-grants contemplated could be managed under the normal procedure. The MacDicken paper describes the need for mini-grants for both prescribed and non-prescribed research and he has presented a number of areas in which research is needed. In some of the areas suggested capability may exist. It is important that money be set aside for nondesignated as well as designated proposals since the field is in its infancy and paradigms about what is appropriate have not been developed.

It would be logical for the expatriate consultants who are knowledgeable in agro-forestry to sit on the selection-review committees.

### Issues in Education and Training

The Project contemplates four different levels of education/training and there are several issues connected with each. The first level is advanced training for educators (e.g. BAU Professors, ATI instructors, Chittagong Institute of Forestry professors) and for researchers (e.g. FRI scientists, Farming system scientists, Subject matter specialists). The second level is middle range training of trainers, training of those (e.g. subject matter specialists and officers, agricultural officers, etc.) who will provide workshops, seminars, short courses, etc. for block supervisors, NGO workers, training institution coordinators, BRDB field organizers, nursery supervisors, and village leaders, etc. The third level of training is for the categories mentioned above who will actually work with households. The fourth level of training is, finally for the householders themselves.

Each level presents special institutional challenges which are outlined below. In general, the project recognizes the importance of training by allocating nearly one third of the total budget of the project for training activities. Because of the complexity, and multi-level foci of the training component the recommendation is to allocate a substantial

number of man-hours of expatriate and in-country personnel to this effort. Training materials for homestead agro-forestry do not exist and will need to be developed. Persons already trained to serve as trainers of trainers are few in number and those that can be found will need to be utilized efficiently.

The persons who head the training component will require flexibility and time to search out the various options for the four levels of training and to sequence the training activities effectively. Each level will have a different emphasis, within each level and between levels different lengths of educational experience will be required, and the nature of the problems and challenges are different.

Level One: Advanced Training for Educators and Researchers - At this level much of the advanced training will need to be conducted out of country although some may be done in-country. Persons who might be selected for this level could be BAU, Chittagong Institute of Forestry, Bangladesh College of Agricultural Science, Sylhet Forest College, or ATI professors as well as senior scientist researchers from FRI (or to be placed at FRI), and researchers from the Farming System Sites. Also to be trained at this level may be trainers from IPSA, CERDI, BARD (Comilla and Bogra) and other leading agricultural training institutions.

For this advanced level training, the issues will be primarily finding the right persons who meet the government qualifications, who can be freed from normal ongoing responsibilities for a length of time sufficient for the training, and whose ages and career patterns will make the investment worthwhile. A related issue is how such people are to be nominated.

Selection and clearance issues are not trivial. In the evaluation of the first phase of the Asian Development Bank community Forestry Project (July, 1984) the evaluation team reported that out of 14 trainees originally proposed for a two year overseas fellowship program in community forestry only 8 had the requisite qualifications. Reports on other projects have pointed out that training components usually experience failures by the various participating agencies to identify, nominate, and free up people, particularly for full time, longer term training. The extensive rules on overseas training outlined in Section III above show some of the procedural problems and delays.

Experience on selection and clearance suggests that the training component staff will need to be particularly alert to these issues and will need to allocate considerable time to encouraging and facilitating the nomination, selection and processing of this category of trainees.

Another problem often encountered is the transfer problem -- after investment in advanced education the trainee is not placed where the training will be put to the best use. For the advanced level training this is not expected to be a key issue since most of those going for advanced education will be nominated by and will be returning to their own institutions. The exceptions would be the ATI instructors who are

transferred regularly throughout DAE, and the Forest College instructors who may be transferred throughout the Forest Department. If regular cadred forest officers were to be included for the FRI researchers advanced training, potential transfer out of FRI could be a serious problem.

Level Two: Training of Mid-Level Trainers - For this level of trainees the problems of nomination and selection are less difficult because the training envisaged is shorter and will be primarily in-country. The selection problem will be almost entirely that of finding those persons who are really interested, who will become "zealots" for the cause of homestead forestry rather than time-servers who like to take advantage of training courses to benefit from the per-diem or to have time away from the normal work routine. Although it will be difficult, some type of screening process should be developed to attempt to screen in those persons who appear most apt to become motivated and effective in advancing homestead agro-forestry.

A serious problem, and one that must be recognized and accepted for this level of trainees, is the transfer problem. As pointed out in Section III above all civil servants are supposed to be transferred at least every three years. This level of training will be directed primarily to subject matter specialists, subject matter officers, district and Upazila agricultural officers, etc. who are employees of DAE. These persons will be transferred on a regular basis. Transfers of those who have been trained can become a problem in three ways, 1) if geographic imbalances occur -- that is if people are trained and then by chance get bunched in certain parts of the country or in certain Upazilas leaving other areas with no coverage, or 2) if training sessions are planned with these people as trainers and they get transferred out, or 3) if training is too much region specific and learning would not be applicable in other regions of the country. Transfers in general are not a problem assuming that a general level of interest and motivation about agro-forestry is important to maintain throughout the system.

In order to overcome the transfer problems listed above, training plans must recognize them. The first can be partially overcome by a rather continuous sequence of training sessions in various parts of the country, the second can be overcome by planning to have backup trainers, and the third can be overcome by not making the training too region specific.

For this mid-level category of trainees it will be important to recognize that sufficient travel and subsistence and attractive surroundings will be needed (many training institutes with adequate facilities do exist). Sufficient money will need to be budgeted to cover these kinds of costs.

Level Three: Training for Block Supervisors, NGO workers, Training Institution Coordinators, BRDB Field Organizers, Nursery Supervisors, Village Leaders - At this level training will be shorter, ranging from several days to several weeks. This training is aimed at those who will actually be in regular contact with farming households. Issues related to

this group are several. Again selection and screening will be important. Attention must be paid to selecting those who are most apt to be in regular communication with households and who have the ability and motivation to benefit from the training. Since the potential pool is so large, special attention will need to be given to finding those categories of people where transmission potential appears to be the greatest. For example, there are 300 female block supervisors. Supposedly they are concentrating on helping, in particular women, (sometimes the farmers as well) to plan and utilize household land. If this concentration is found to be predominate, the women block supervisors would be an important priority focus. Further information will need to be obtained, however, about the longevity of women in the extension service and their potential career patterns. Since the use of women in these roles is fairly new experience over the next few years is needed to provide additional evidence about their roles. By the time this level of training can be started several years into the project a great deal more can be known.

Another focus might be with NGO groups who have special connections with smaller farmers and with those who have only homestead land. There is some evidence for example that block supervisors and BRDB cooperative organizers have worked primarily with the larger farmers although BRDB has a new role of working with the functionally landless. (See Annex VII) Training institution coordinators who arrange and oversee special programs for contract farmers and others make up another potentially important pool as do nursery workers, both public and private, who sell directly to farmers. Prioritization among the potential pools and within pools will be essential.

A second issue will be reaching the persons in the priority pools to inform them that training is available. Special channels will have to be developed. Although subject matter and agricultural officers at the Upazila levels can be helpful they may not be in regular contact with or knowledgeable about nurseries or NGOs. ADAB (the central organization of NGO's) can be helpful in identification and contact with the latter.

A third issue will be sufficient funds to enable this category of persons to attend sessions. Travel funds and per diem for subsistence and forgone wages will be important.

A fourth issue will be the level of the training. Some of these people will have only minimum literacy -- tenth grade in rural schools will be the maximum. Training materials will need to take this into consideration.

Level Four: Training of Farmer-Householders - The end product of all the training of educators and trainers described above is to increase the capability and motivation of the householder to incorporate trees into the household or farm system. By the fourth or fifth year of the project the training of trainers at Levels 1 through 4 should begin to payoff in

reaching rural households. Creative ways to augment the person to person activities of the block supervisors in reaching farmers will need to be devised. Mobile training units, field days, nursery visits, etc. will need to substitute for more traditional training methods.

Again, the primary issue here will be in actually reaching the householders, particularly the most needy and uninformed. A related issue will be the need to provide the funds to enable householders (including women) to travel and forego other income generation so that they can participate. Finally the training experiences will have to be at a level appropriate to the audience and with built in incentives for learning.

#### Dissemination - Extension Linkages

In other sections emphasis has been given to the use of the Department of Agriculture Extension to provide the linkage (including motivation) between agro-forestry research and the householder. Also, the section on training issues has outlined the training of trainers stream of linkages for ultimately reaching the householder.

In this section two other linkage avenues are briefly explored. The first is the use of non-Governmental organizations as one linking mechanism, the second is the use of nurseries as an alternative or additional linkage stream.

In Section II some of the overload and other problems of agricultural extension have been discussed. Although the project intends to place heavy emphasis on the utilization of the agricultural extension network for dissemination of information and motivation of householders, a realistic look at DAE capabilities suggests that additional avenues should definitely be explored to provide alternative channels to strengthen and add to the impacts.

The use of NGOs - There are at present some 250 NGOs operating various kinds of programs in 8 Districts within the country. Approximately 200 of these, many of which are very small, are believed to be running programs that have a direct relationship to farmers and/or farm households. NGO field staff are, for the most part, dedicated workers whose intentions are to improve the lot of rural people. Because their activities are carried out at the village level they often have wholesome contact with farm households and can therefore provide a channel through which agro-forestry concerns can be transmitted. Some NGOs have already demonstrated an interest in tree planting -- the principle examples are BRAC, and RDRS. Through these two NGOs alone hundreds of thousands of trees have been planted on homesteads or on village roads over the past several years.

Discussion with a number of NGO leaders has suggested that the linkage could be usefully activated in several ways. First, NGOs could send their field staff to agro-forestry training sessions to improve their knowledge

and increase their motivation, second NGO field workers could become a distribution channel for improved planting materials, and third they can provide a method of identifying and recruiting key householders for various training experiences (workshops, field days, demonstrations, etc.).

The NGOs can be identified and reached through their central coordinating organization, ADAB, which has headquarters in Dhaka. The organization has regular meetings and publishes regular newsletters and reports. It has also developed a catalog of all NGOs.

One suggestion has been made that mini-grants could be offered to NGOs to stimulate them to include agro-forestry concerns in their village work, to provide training for the farmers with whom they work and for the costs of distributing improved planting materials (not necessarily free) to the farmers.

Several NGOs interviewed, particularly the larger ones, would not be interested in or need mini-grants. What they would welcome is some training for their field workers in agro-forestry and a guaranteed source of high quality planting materials appropriate to their regions. Some of the smaller NGOs may need small amounts of grant assistance.

The institutional issues involved with utilization of NGOs are two. The first is the fact that many are small and all of them together do not cover the entire country. They reach limited pockets, although in the pockets where they do work the effect is often significant. The second issue is the reluctance on the part of some government organizations to work with NGOs. Government officials interviewed have split about evenly on the efficacy of using NGOs. Several recent government projects have formally entered into contracts with major NGOs (BRAC and Proshika) to assist the government with outreach which demonstrates that acceptance of NGO efforts is increasing. However, some officials remain suspicious of or fear NGOs because many are religious based (primarily Christian), some of the smaller and recently organized ones are corrupt, and some are felt to be anti-government or too political.

This avenue of linkages is strongly recommended but care will have to be taken to choose reliable NGOs and to obtain the acquiescence of the government.

Nurseries as Linkages - A second important means of linking agro-forestry research and existing knowledge to rural households is through nurseries. Although the design team did not have time to explore in detail the existing public and private nurseries it is clear that nurseries provide a significant source of information and planting materials for householders. In the research done by Professor Khaleque (see Annex G) 2/3 of the farming families interviewed knew about government nurseries and 2/3 of those who knew had purchased seeds or seedlings from government

nurseries in the last few years. If these findings are representative of the country as a whole nurseries provide one of the key linking mechanisms. The farmer respondents reporting having more contact with nurseries than with block supervisors or other agricultural agents.

Several chains of government nurseries are known to exist although the team was not able to judge their quality or operational efficiency. Brief visits to several of both forestry and horticultural nurseries clearly established their existence but found the quality of the nurseries somewhat lacking. There are 64 horticulture base nurseries in the country, providing primarily fruit trees and vegetable seeds, and somewhere between 50 and 100 forest nurseries providing primarily forest species. The ADB community forestry project is in the process of expanding and improving the forest nurseries. Also, each Upazila is expected to begin a small nursery over the next few years. At present, it is reported by DAE that half of the 460 some Upazilas have begun to establish nurseries, almost no attention has been given to high quality plant sources. BADC also has nursery outlets although primarily for crop seeds.

None of the nursery chains appear to have satisfactory links with the research community (more on this in the Geary and MacDicken papers). Apparently no regular process for feeding improved knowledge or planting materials into these nurseries presently exists. The nurseries appear to be under-financed or poorly managed.

In spite of the apparent weaknesses, nurseries are an essential link with the householders and without a consistent and available supply of high quality planting materials to the field the entire project will founder.

It is therefore strongly recommended that careful attention be given to the role of nurseries as an essential linking mechanism. Private nurseries also exist at the town, village, bazaar and hat levels. These too can be utilized if proper quality control can be achieved (See Geary paper for more on quality control concerns.)

Because of the importance of nurseries as linkages, and because this mechanism in a complex and relatively unexplored one, a strong recommendation is made that the project staff include a person qualified in social marketing who can explore carefully the issues and problems connected with the dissemination of quality planting materials. It would be ideal if such a person had agro-forestry knowledge but the key skill required is knowledge and experience in evaluating and activating marketing mechanisms that can link existing or new knowledge and improved materials with the ultimate users. This person would likely have to spend full time for two to three years to understand existing systems and figure ways to activate improved. system.

## ISSUES IN PROJECT IMPLEMENTATION

William Leuschner

Three issues are discussed in this section. They are (1) The Tasks of the Agroforestry Economist, (2) The Role of the Private Sector, and (3) Biomass Consumption in Bangladesh.

### Agroforestry Economist's Tasks

Agroforestry Economists at FRI will have three general tasks.

1. Outline or design broad research projects to provide the social-economic information needed to implement on-farm forestry. These include:

- a. Social acceptability studies defining tree/shrub/bamboo plant materials which are desired by farmers in the different regions.
- b. Yield studies for tree/shrub/bamboo cropping systems being tested on the FSS.
- c. Cost studies on tree/shrub/bamboo cropping systems being tested on the FSS.
- d. Farm budget-profitability studies which combine the preceding elements to assess the social and economic feasibility of proposed tree/shrub/bamboo cropping systems.

2. Work cooperatively with the FSS Agro-Foresters to develop, analyze, and disseminate research results. More specifically:

- a. Assist in the FSS study design including advice on social study questionnaire, study layout, sampling, measurement, and data collection form design.
- b. Travel to all FSS and collect data.
- c. Perform social acceptability, yield, cost, and economic feasibility analyses on above data.
- d. Write reports and BFRI publications documenting research results. Author or co-author papers for research journals. Present papers at meetings and seminars and otherwise disseminate research results.

3. Actively participate in discussions and planning to design new and modify old tree/shrub/bamboo cropping systems. Provide planners with advise on the social and economic feasibility of these systems based on research results and field experience.

- a. Assist all other parties in evaluating tree/shrub/bamboo cropping systems.

### Qualification

The incumbent should have a masters degree in forest economics or a closely related field. Other highly desirable experience and/or education is rural development, and forest biometrics. Specific, helpful skills include:

1. Survey research and interviewing techniques.
2. Investment analysis and discounting.
3. Yield measurement, estimation, and projection.
4. Statistical analysis including regression, analysis of variance, and significance testing.
5. Past experience on micro-coputers.

### Pre-Project Activities

A few steps may be possible before project initiation. The incumbent might be identified and his level of expertise assessed. This person may require additional short-term training in one of the specialty areas or may even be sent for long-term overseas training to obtain an MS in forest economics.

It is recommended the incumbent be provided transportation to travel between the FSS. An auto may not be appropriate but perhaps a road worthy motorcycle would be. A micro-computer installation for the Agro-Forestry division should also be strongly considered. It would provide the incumbent and other project members access to modern analytical and data manipulation techniques. These items might be procured before project initiation.

### The Role of the Private Sector in Seedling Production and Distribution

Seedling and information are the two critical inputs for this project. Seedlings are critical for several reasons.

First, growing a few plants on a homestead does not require significant amounts of unavailable inputs other than seedlings. Most other inputs are not critical for survival or are readily available at the homestead.

Second, control must be maintained over the planting stock delivered. This project will distribute improved planting materials. Several candidate species may require vegetative propagation to maintain higher yields. Seed sources for trees initially distributed must be known for other species. Loss of control could endanger project effectiveness.

Third, another part of the project matches plant species and growing sites. This requires that the right species be available in the right location. Similarly, planting should occur before the rains to improve survival thus timely delivery is important.

Finally, it will be important to coordinate planting material propagation and distribution with the research organizations developing the improved and exotic planting materials. This is necessary so the farmers receive higher yielding materials. Rapid dissemination of improved stock is important so that farmers will receive project benefits as soon as possible.

All of these preceding considerations indicate the need for control and monitoring of the research, propagation, and distribution process. Further, private sector nurseries are not uniformly well developed throughout Bangladesh. Thus, public sector nurseries must at least be examined. Many different combinations of public and private organizations can be envisioned which might accomplish adequate distribution. However, the Design Team believed that too much confusion and uncertainty existed to determine the best system. It was believed that the situation might stabilize sufficiently by project implementation and thus the Team advised the contractor make the final determination. Therefore, this document will discuss a few different scenarios and their pros and cons. These are certainly not exhaustive but will hopefully set bounds within which the system can be developed and will help the contractor examine the possibilities.

#### Delivery Scenarios

The first scenario is an all government operation centered in the Department of Agricultural Extension (DAE). A large central nursery might be established or the 64 Horticultural Base Nurseries, said to exist, could be used for planting material propagation. Distribution could be made through the planned upazila nurseries and from there to farmers by Subject Matter Officers and Block Supervisors. Forestry Department nurseries might also be used.

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System advantages are that the entire process is under one administrative unit and control should therefore be easier. Further, the personnel should be trained in propagating and distributing plant materials. Negatively, government agencies have not been uniformly successful in distributing inputs (e.g. fertilizer), the upazila nurseries are not yet built, and private enterprise is not encouraged. Further, shipping seedlings and soil from a central nursery, as opposed to the 64 Base Nurseries, will be difficult.

Another scenario is a mixed system with government nurseries used for part of the process and private parties used for other parts. A central or several of the Base Nurseries could propagate the materials and then sell them to private wholesalers who in turn would transport them and sell them to private retailers. Alternatively, only the private retailers might be used.

Advantages of this system are that government nurseries at the top may help quality control and private sector participation is encouraged. Disadvantages are that adequate demand may not exist during early project years to support private sector participation, control is lost over delivery timing, and farmers may not be able to distinguish between improved planting materials and other non-improved materials the retailers sell.

An all private system is the final scenario. Here the entire operation is turned over to the private sector, from the procurement of improved materials from the research organizations, through propagation to delivery to farmers. One option is to encourage the private sector but to leave development in its hands. Another option is to issue tenders for a Bangladeshi contractor to develop the system. The entire development could be left to one contractor or contractors at several distribution levels could be encouraged, for example, propagation, wholesale, retail, and transportation between these levels.

This scenario provides greatest private participation but also the least control over delivered quality and quantity. Coordination between research and extension organizations may also be difficult. Finally, lack of aggregate demand in early project years may make unsubsidized private participation impossible.

#### Delivery Summary

The uncertain delivery system at this time makes it logical to defer decisions until project implementation when the system may be more stable. It would seem a combined government and private system would be best. Perhaps an all government system is needed in the early project years until demand builds and farmers develop a "brand loyalty" to the improved planting materials. A gradual shift could then begin from all public to limited private participation. Perhaps this should start at the retail level and work backwards up the

distribution chain. Periodic judgements could then be made about the desirability of relinquished control over quality and quantity as the private sector develops.

### Information System

An information delivery system is of parallel importance to a planting material distribution system. The plants are of obvious importance. The need to inform farmers of the relative benefits of the new planting stock and to instruct them in its care and management should also be obvious. The planting material is unlikely to reach its full potential use without an information system to inform farmers of potential benefits and plant management techniques to obtain them.

Examination of the information system parallels that of the delivery system in that all public, mixed, or all private systems are at least possibilities. The most likely all public system is in the DAE and follows their chain of command. The final link for farmer contact is the Block Supervisor. However, the Design Team's Institutional Specialist believed that the Block Supervisors are currently overworked and that it is unlikely they will make all the contacts. It was suggested that the Subject Matter Officers and Specialists might make these direct contacts. Private voluntary organizations may also assist.

The other extreme is an all private sector effort. This would have to be implemented on tenders with a contractor because there is no product, such as seedlings, to sell. Private sector involvement would require contracting to develop an instruction package (in consultation with research, social marketing, and other personnel) and to instruct farmers in the field. This approach will foster private sector participation but private sector trainers may not have authority or status that government officers may have.

The mixed system might use both the DAE and the private consultants. The DAE structure and authority for information distribution might be augmented by private sector field teams which prepare and deliver the actual message to the farmers. Alternatively, this function could be performed by the Graduate Training Institute (GTI) at Bangladesh Agricultural University (BAU). This group contracts such programs and seemed particularly adept. Finally, private voluntary organization involvement could also be included.

In summary, many different combinations of public and private involvement exist to deliver information about project benefits and recommended management practices. The Design Team has recommended a social marketing specialist for one of the expatriate positions and no final decisions should be made about either planting material or information systems until that analysis is made. However, the social marketing expatriate should be one of the first to arrive and the

analysis should be completed within, say, 18 months so the structure can be built and the instruction given in time to receive the planting materials when they are available.

Regarding the structure, my current inclination is to work within the DAE because it is already organized and has an existing field staff. I would augment DAE's effort with mobile field level instructional teams from GTI and private voluntary organization activities. Field teams should first visit targeted upazilas and villages to inform farmers, teachers, and religious and other community leaders about the program and its potential benefits. Consideration can then be given to expanding this involvement to management practice instruction.

### Biomass Consumption in Bangladesh

Biomass is non-food plant material consumed by humans. The relatively small value/weight ratio of unprocessed wood products usually precludes shipping them great distances, particularly in a developing nation where the transportation infrastructure is developing also. Thus, the biomass will not be transported great distances. Project focus is on-farm and the transportation limitation restricts consumption to the surrounding area and therefore only the rural population is considered. This is, perhaps, a simplification but is unlikely to lead us severely astray because only about 10 percent of Bangladesh's population is urban and because they are increasingly using gas and non-biomass fuel substitutes.

Most of the necessary data are drawn from the UNDP-FAO project "Supply and Demand of Forest Products and Future Development Strategies", (UNDP/FAO/78/010). This project documents the results of a several year study which could not begin to be duplicated in a five week consultancy. For example, the consumption results are based on a Main Survey covering over 6,000 households in 430 villages and 47 Thanas and a Full Measurement Survey which is a 20 percent random sub-sample of the Main Survey. Great care is taken to assess study results, compare them to previous studies where possible, and then rationalize the differences. It is my opinion that this is a thorough and carefully executed study producing good results considering the inherent difficulties in a developing nation. Some results are necessarily based on judgement but, although my judgement might differ in individual cases, it would be hard to perform a better overall study.

Results have been converted to pounds per capita per year and to kilocalories (kcal) per capita per year for comparability (Table J1). Data sources are included in the Table. The biomass consumption per capita per year for the Bangladesh rural population in 1980 is estimated as 1.15 million kcal (Table J1). This compares to Islam's (1978) 1.0 million kcal, Briscoe's (1979) 1.65 million kcal, and

Douglass's (1981) 1.06 million kcal estimates. The major difference between this and Douglass's estimate is that Douglass omits the brick burning consumption and some recycled bamboo fuel and also adjusts fuelwood estimates for comparability to standing volumes. Thus, Table J1 estimates are reasonably consistent with earlier work and appear valid.

TABLE J1.

BANGLADESH RURAL BIOMASS CONSUMPTION PER CAPITA PER YEAR

Biomass	Source Table	Pounds	Kcal/lb	Thou Kcal/yr	% Kcal
Wood					
Fuelwd & Brnch	C-4	186.9	1404.1	262.4	23
Fuel-Othr Tree					
Parts	C-4	229.8	1404.1	322.7	28
Const & Miscl	2.8-2.10	22.9	1401.1	32.2	3
Fuel-Brick Burn	2.1	26.1	1404.1	35.7	3
Agricultural					
Residues-Fuel	C-4	314.0	1323.8	415.7	36
Bamboo					
Fuel	C-4	60.5	1323.8	80.1	7
Construction	2.8	10ea			
Charcoal	C-4	5.8	351.0	2.0	<1
TOTAL -		819.9		1151.8	100

Source: Douglass (1981) unless otherwise indicated.

a. kcal/lb from Table 2.2. Agriculture residue is weighted by Table 2.3 =  $((445 \times 2791) + (1231 \times 3015) + (65 \times 1789)) / 2.2 / (445 + 1241 + 65) = 1323.86$ . Charcoal =  $.25 \times 1404.1 = 351.0$  (see Byron 1981, p.54).

b. Wood-Construction & Miscellaneous derived from  $0.432 \text{ cu ft} \times 53.03 \text{ lbs/cu ft} = 22.9 \text{ lbs}$ .

c. Wood-Fuel-Brick Burning source is UNDP (1981), Table 2.1. Calculations are:  $0.014 \text{ cu m} \times 35.2 \text{ cu ft/cu m} \times 53.03 \text{ lbs/cu ft} = 26.1 \text{ lbs}$ .

d. Bamboo-Fuel includes branches, leaves and deteriorated construction bamboo. This amount would already have been considered a cut, or a reduction in growing stock, in other categories.

Table JI contains most non-food human consumption of biomass. Fuel is certainly the largest single use category covering 97 percent of all kcals consumed. This includes three percent used for brick burning. The remaining non-fuel three percent covers a wide variety of uses. These include homestead and public building construction, furniture, homestead and farm implements, and transportation devices such as boats and carts. Non-human consumption, such as fodder for livestock, composting, fertilizing, and decomposition or burning in agricultural fields is not included. These are other, competing uses for agricultural residues but are these likely to be residual uses because fuel is a nutritional necessity. The inability to cook rice, or other fodds, leaves only the alternative of not eating. Thus, fuel, in some form, is very high priority biomass use.

Distribution of consumption shows that wood or wood products, including bamboo, account for almost two-thirds of consumption. Alternatively, agricultural residues account for 36 percent of consumption. Islam (1983) compares results of the nine Bangladesh energy studies. Five of the eight studies reporting consumption by source show tree products accounting for 57 to 74 percent of consumption. Islam points out that "Variation in composition of fuels to forest, cropping pattern, physiographic conditions, etc." All but two of the studies were micro studies dealing with a limited area and did not attempt to assess national consumption. These studies are particularly susceptible to locational influences. Using Douglass's results is supported because of the similar results in other studies and because his findings are national estimates.

Islam (1983) also points out the seasonal nature of consumption. Crop residues and dung can not substitute for fuelwood in the wet season because villagers are unable to dry them. Thus, some amount of non-agricultural fuel will always be needed. He also says "... residues suitable for fodder are not normally used as building materials or fuel. Fodder grade agricultural residues are exchanged as a commercial commodity." Thus, burning agricultural residues, or at least those useful for fodder, may only occur when the residues are sufficiently available to meet alternative uses and still provide a surplus for fuel. Both of these reasons imply that wood may be a preferred fuel although that will depend on relative prices in the latter case.

I therefore conclude that tree/shrub/bamboo based fuels will always be desired in some non-zero amount. This will occur because substitute fuels are not readily available in the wet season, may have alternative higher value uses, and do not seem to be the fuel of first choice. Nationwide use appears to be above the 50 percent mark indicating that relatively large amounts are needed. Assuming a 78.7

million rural population (Byron, Edelman, and Manson 1983) and the Table J1, 41.4 billion pounds of wood a year will be used. Projections of declining forest and homestead tree inventories (e.g. UNDP-FAO 1982) leave little doubt that actions to reverse depletion and increase availability for an increasing population are an important policy consideration.